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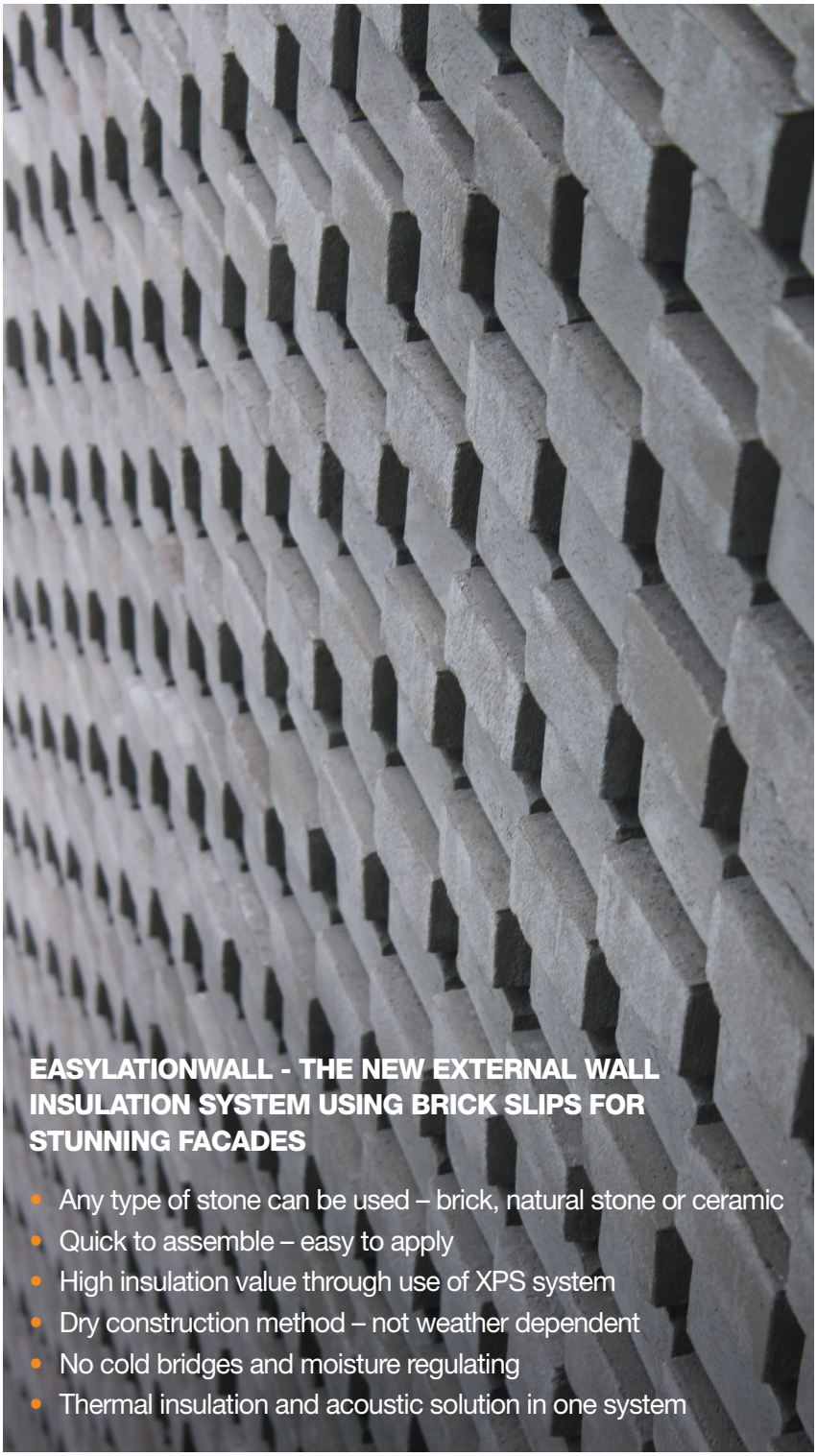

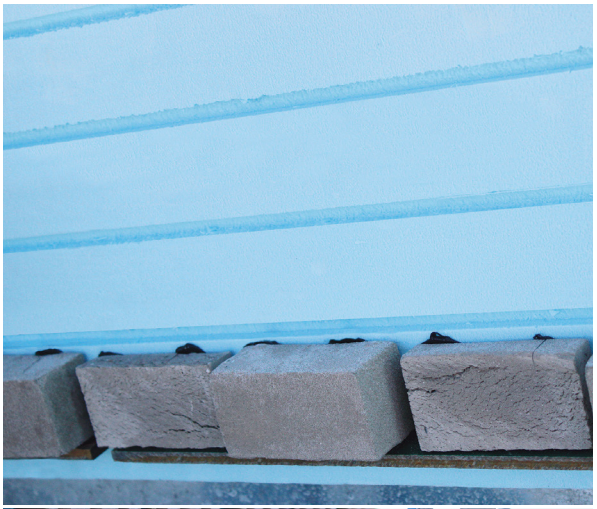

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editor's letter

Passive House Plus's reach is about to grow, due to a decision my colleagues and I have taken, after much contemplation. Two months after each new issue of the magazine is published in print and digital form, it'll be added to a digital archive – along with all of our back issues – and made freely available on www.passivehouseplus.co.uk.

If you haven't checked out our digital edition yet, now is a great time to start. It has the obvious benefit that we can embed links in adverts and articles to external websites, and thereby make it as easy as possible for you to chase up any new product, company or piece of information that caught your eye. It also enables you to copy links to specific pages in the magazine – for an article or advert that's made an impression on you – and share it on social media, email or however you see fit.

Publishers the world over are struggling to work out how to utilise the disruptive effect of the internet to develop new models for their businesses – and to use this change as an opportunity for growth, rather than a threat. We're no different.

So on the one hand we feel a need to make the content of Passive House Plus available to anyone who might be interested. On the other hand we have to bring in income. This enables us to invest the time and resources in producing reliable, quality content to inform and educate our readers, and to engage in campaigning journalism to reduce the impact that the built environment has on the natural environment. Reconciling these positions isn't easy. Part of the solution we've reached is that paid subscribers gain exclusive first access to each new digital issue for two months. The cost is negligible - €10 for a digital only subscription, and €25 for a full (print and digital) subscription, rising to €45 for readers outside of the UK and Ireland. And we continue to offer free digital subscriptions to students.

But the reason for subscribing goes beyond first access to the magazine, or sponsoring our work. There are some exceptional digital features we offer that won't be free, such as the online galleries of architectural drawings of featured buildings. It's not possible to do justice to drawings of construction details in an A4 publication. We're fortunate that the designers of most of the exemplary sustainable & low energy buildings we feature are willing to share drawings that reveal how they detailed each building for airtightness, thermal bridging, and more. If you look at the end of each case study in this and every other issue of Passive House Plus, you'll typically see a reference to these image galleries. In the digital magazine, that becomes an active link to the image gallery for that particular project, which only subscribers can access.

Make no mistake. Our commitment to print – a more tactile, immersive experience without the distraction that comes with internet connectivity – is unchanged. That's evident in the fact that we're increasing the print runs on both Irish and UK editions by 1000 copies each, starting with this issue. But the digital magazine offers exciting possibilities to extend our readership further still, and to link the magazine into the fabric of discussion around sustainable building online. It's an opportunity that we can't ignore.

Regards,
The editor

International PASSIVE HOUSE Association — iPHA

An official partner magazine of The International Passive House Association

AECB building knowledge

Passivhaus Trust — The UK Passive House Organisation

An official partner magazine of The Association for Environment Conscious Building and The Passivhaus Trust

IMA 2012 Business magazine of the year - Irish Magazine Awards

GREEN AWARDS 2010 WINNER Green Leader Award — Jeff Colley: winner green leader award -Green Awards 2010

GREEN AWARDS 2010 WINNER Green Communications Award — Construct Ireland: winner green communications award -Green Awards 2010

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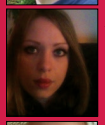
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Cover: Passive House M
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contents

News

AECB to run varied range of passive house courses

The AECB, the Association for Environment Conscious Building, is hosting a number of passive house courses this spring – ranging from courses to become certified passive house designers to "bite size" training sessions for designers who wish to familiarise themselves with the standard.

The association is running a series CarbonLite passive house designer courses around the country, commencing on 8 February in Plymouth, 9 May in London and 5 September in Hereford. The courses are each split into two weeks, separated by a gap week.

With passive house expertise more and more in demand, AECB CarbonLite courses offer the chance to gain the internationally recognised certified passive house designer qualification. At the same time, participants will benefit from material uniquely tailored to UK building situations and showcasing UK examples. Those interested in attending can take the full passive house designer course, leading to the exam, or individual modules to improve specific areas of knowledge.

The AECB's trainers are highly experienced UK experts including Bill Butcher, Eric Parks, Mark Siddall, Alan Clarke, Marine Sanchez, Sally Godber, Will South and Nick Grant, as well as leading passive house certifier Peter Warm and the rest of the Warm staff, who have supported over 200 buildings in low energy design.

The AECB's courses have been running and continuously updated for over five years.

The two-week programme is delivered using a mixture of lectures, group and individual learning, and includes site visits to innovative passive house developments, and a chance to socialise and build a support network of passive house professionals.

The association has also announced affordable "bite size" courses for designers who want to learn the fundamentals of passive house design without training to become a certified passive house designer. Taking place in the Pollard Thomas Edwards offices in London, the four part passive house course will include a session on the fundamentals of passive house on 23 February, a session on construction – focusing on what works in practice – on 1 March, a session on building services on 8 March with an emphasis on smart design approaches for services suitable for buildings with greatly reduced energy demands, and a final session on 15 March called Project Crit – a chance for participants to gain input on their own projects from the group.

Meanwhile the AECB is also running an online course in the thermal bridging calculation software Therm. The new online Therm course allows participants to learn at their own speed and in their own time.
For more details see www.aecb.net

(above) A previous AECB CarbonLite training course at the Plymouth National Marine Aquarium

Stephen Fry to speak at Ecobuild 2016

Stephen Fry has been announced as the special guest at Ecobuild 2016, the UK's largest show dedicated to construction and energy. The erudite writer, actor and campaigner joins a lineup of industry leaders and experts.

Fry will be interviewed by broadcaster Will Gompertz at the culmination of the day's conference programme on Wednesday 9 March.

The audience can expect to hear Fry's forthright and entertaining views and insights around issues close to his heart. The session will afford audience members a rare opportunity to ask questions in a Q&A session.

Martin Hurn, director of Ecobuild, said: "Stephen personifies the spirit of Ecobuild to inform, entertain and inspire the industry. He is the most exciting speaker we have welcomed in Ecobuild's history of thought leadership. We couldn't have hoped for a better conclusion to what promises to be a fascinating day on the Ecobuild Arena."

After the discussion, Fry will go on to host the prestigious BD Architect of the Year Awards dinner held at ExCeL that evening. Recognising excellence across 13 categories, the awards celebrate the very best practices currently operating in the UK. For further information about Ecobuild 2016 which takes place from 8 to 10 March at London's ExCeL, visit www.ecobuild.co.uk.

News

25th International Passive House Conference goes back to roots

Passive house is now 25 years old, and to celebrate this, the International Passive House Conference is returning to Darmstadt – the German city in which this success story began. On 22 and 23 April 2016, over a hundred speakers from all over the world will report on the latest projects relating to passive house construction and retrofit. But the anniversary will also provide an opportunity for review, with the presentation of results on the durability of the individual building components of the first passive house. The complete conference programme is available online at www.passivehouseconference.org, and registration is now open at an early bird rate.

The programme of the International Passive House Conference 2016 will also cover many other topics including, among other things, how buildings can combine efficiency and renewable energy and thus meet the criteria for the new passive house plus and passive house premium certification classes. Meanwhile this year's passive house component award will focus on home ventilation systems, while the main regional focus will be on North America, China and warm climate zones.

The lecture programme at the conference will be supplemented with a series of workshops and excursions to passive house buildings in Darmstadt and its surroundings – including the world's first passive house that was built in the Kranichstein district 25 years ago. Leading manufacturers of passive house components will demonstrate their latest products at an accompanying exhibition.

The International Passive House Conference has been held by the Passive House Institute annually at different venues since 1996. The event will be taking place in Darmstadt again for the first time since the premiere 20 years ago. This year's conference will be organised in cooperation with the City of Darmstadt, the Darmstadt University of Applied Sciences and the University of Innsbruck. The conference will be held under the auspices of the Ministry for Economic Affairs, Energy, Transport and Regional Development of the German State of Hessen.

(left) The first passive house, a four unit terrace built in the Kranichstein district of Darmstadt in 1991, will be available to visit as part of the International Passive House Conference

Light + Building show returns to Frankfurt this March

This year's Light + Building show, the leading European trade show for lighting and building services engineering, takes place from 13 to 18 March at Messe Frankfurt, Germany. In addition to its exhibition of the latest and most innovative products, the show will feature an extensive complementary programme of other events.

This will include a series of talks from leading experts, and award ceremonies for the most innovative products and design trends. This year's event will place a particular focus on safety and security technology, building information modelling (BIM), advances in digital building technology and trends in the lighting market. Light + Building is targeted at architects, engineers, planners, interior designers, tradespeople, wholesalers and retailers, and all those working in the industry.

This year the new special show 'Digital Building' will pick up on Light + Building's motto of, "where modern spaces come to life", and will focus on the integration of technology and services in modern non-residential buildings.

Meanwhile the 'E-House' demonstration dwelling will demonstrate what networked building services technology and intelligent energy management look like for the end consumer, and how it is possible for energy efficiency and increased comfort, convenience and security to go hand-in-hand.

The 'Futurecourse' debating forum will bring together representatives from politics, commerce and industry for lively debate, while at 'Workshop Street' young trade visitors and trainees from the electrical and information technology trades will have the chance to learn about the latest practical techniques and installation procedures. There will also be a special promotional area for innovative startup companies, a job exchange for exhibiting companies to advertise vacancies, and a university area for third level institutions to present their research and information about relevant courses on offer.

A cultural highlight at Light + Building this year is Luminale. This Biennale of Lighting Culture takes place at the same time as the trade fair in both Frankfurt am Main and Offenbach, and offers a programme of entertainment for visitors to Light + Building. For more information, see www.messefrankfurt.com.

(below) Light + Building 2016 will give visitors an opportunity to gain insight into the future of building design

News

Overheating masterclass in London this February

Industry experts Mark Siddall and Nick Grant will deliver a masterclass that examines the potential causes of overheating, and how to design, build and operate a passive building in order to prevent overheating problems, on 15 February in the Saint-Gobain Innovation Centre in London. The cost is £150 plus Vat for Passivhaus Trust members, and £200 plus Vat for non members.

Passive house buildings are often rightly described as warm, comfortable, free of draughts and condensation, and free from worries about heating bills. However, a number of concerns have arisen regarding summer overheating in modern UK homes. Additionally it is often assumed that overheating is caused by high levels of insulation and airtightness, which can be misleading.

In this masterclass, passive house experts Mark Siddall and Nick Grant will explore the causes of summer overheating and provide tools and guidance to help deliver buildings that don't just minimise overheating but deliver excellent summer comfort. Working with built project examples and PHPP, the event will cover basic theory, practical details and evidence from case studies and personal experience.

Key topics will include summer ventilation, practical case studies and examples, PHPP tips and tricks for stress testing your design, and how to address operational issues. To book please contact roger@passivhaustrust.org.uk.

(below) Passive house specialists Mark Siddall and Nick Grant will be delivering a masterclass on overheating on 15 February

Construction sector commits to big carbon savings at COP21

The UK Green Building Council has come together with Green Building Councils from around the world to publish a series of commitments from the private sector that would result in massive carbon savings from buildings and construction.

Formally published at Buildings Day at the COP21 international meeting on climate change in Paris last December, the commitments include corporate pledges from more than 50 businesses operating in the UK, and over 100 globally, committing to play their part in delivering the necessary carbon reductions. UK Green Building Council members to issue corporate pledges on carbon included major construction companies and developers such as The Crown Estate, Marks & Spencer, British Land, LendLease, Land Securities, Derwent, Argent and Kingfisher.

Meanwhile all 74 national Green Building Councils, under the umbrella of the World Green Building Council, committed to driving 'net zero carbon' new building and large scale energy efficient refurbishment of the existing building stock. The sector must reduce emissions by 84 gigatonnes of CO_2 by 2050, the equivalent of taking 22,000 coal-fired power stations out of existence. Green building councils around the world committed to register, renovate or certify over 1.25 billion square metres of green building space (twice the size of Singapore) and train over 127,000 green building professionals by 2020.

Julie Hirigoyen, CEO of the UK Green Building Council, said: "There is a clear business case for the construction and real estate sector to cut carbon emissions from buildings. The climate pledge commitments from our members demonstrate the widespread industry support for urgent action, and point to a market that is transforming itself."

Meanwhile World Green Building Council CEO Terri Wills commented: "Today marks a turning point in history. Politicians and business leaders now jointly recognise that the way we build can lead to economic growth and prosperity without risking life on the planet, and that the private sector is a driving force in achieving this goal.

"While the building sector is a major contributor to climate change, it is an essential part of the solution – and one that brings immediate benefits to economy and society. Green building councils, their private sector members and government partners have committed to transform the global buildings industry to not only help us reach a two degree world tomorrow, but enable us to realise the direct benefits from a new way of building – today."

News

Bristol City Council aim for 'passive house plus' with 23 new eco homes

Bristol City Council have appointed Gale & Snowden Architects as lead consultants on a scheme of 23 dwellings aiming for passive house plus certification. This new development is spread across five brownfield sites, and all the units are also designed to meet Code for Sustainable Homes level four and Lifetime Homes standards. It is one of a number of new passive house developments that Gale & Snowden is working on, including the recently announced Rennes House social housing scheme of 26 one and two bedroom flats in Exeter.

Gale & Snowden Architects said that its approach to sustainable construction is to rigorously employ passive house design principles to ensure that, through a fabric first approach, its buildings use minimum amounts of energy and water; while being comfortable, easy to use and healthy for the occupants by meeting 'building biology' best practice guidance.

The units in the Bristol City Council development are designed to meet the new 'passive house plus' standard, which rewards buildings that generate renewable energy on site as well as meeting the rigorous traditional passive house energy efficiency requirements. The development will feature rendered masonry walls and trussed timber construction with clay tiles externally.

Meanwhile the landscape design will focus on food production, water, energy and shelter in a way that also enhances the natural environment by employing permaculture design principles. It will aim to integrate the new development with its surroundings and creates a sense of ownership and community among its residents.

Enabled by funding from the Technology Strategy Board, Gale & Snowden has been at the forefront of developing integrated design strategies that help to extend the useful life of a building by future proofing it against the effects from climate change without adding costs to a project.

(above and below) Site plans and elevations of some of the new Gale & Snowden designed passive house plus dwellings for Bristol City Council

Kingspan reports sustainability success & net zero energy progress

Kingspan Insulation has published its latest Sustainability & Responsibility Report, highlighting a year of continued growth and sustainable development. To ensure transparency, the report has been conducted under the rigorous requirements of international independent standards organization the Global Reporting Initiative. As per Kingspan's previous reports, the company was assessed against the GRI's Sustainability Reporting Framework Level B+, which is backed with external assurances.

The report highlights the company's continued work towards the goal of net zero energy demand across all Kingspan Insulation sites. A range of energy saving measures have been implemented at the firm's manufacturing facility in Pembridge, Herefordshire, and two new anaerobic digesters are now providing heat and power to the site.

Kingspan Insulation is firmly committed to maintaining the highest standards in responsible sourcing. All Kooltherm, KoolDuct and Therma insulation products and cavity closers manufactured at its sites in Selby and Pembridge are now certified as 'Excellent' under the the BES 6001 (Responsible Sourcing of Construction Products) standard.

The report also provides an overview of the latest product developments, with the Kingspan Optim-R vacuum insulation panel moving into full scale production. The panels provide an optimum level of thermal efficiency, with a minimal product thickness, and a number of new system applications have been brought to market, including the popular Kingspan Optim-R balcony and terrace system.

Kingspan has also announced the launch of a new 172mm Kingspan TEK panel, which allows U-values of 0.16 W/m^{2}K, or better, to be achieved in both Kingspan TEK building systems and Kingspan TEK cladding panel applications, without the need for additional insulation.

(below) A range of energy saving measures have been installed at Kingspan's facility in Pembridge, including a 799kWp solar photovoltaic array

News

SmartPly chosen by Greenpeace for emergency humanitarian project

SmartPly, the leading manufacturer of oriented strand board (OSB) provided a rapid, reliable solution for a humanitarian project coordinated by Greenpeace UK to build emergency accommodation for homeless families in time for Christmas.

Due to its strength, versatility and environmental credentials, two pallets of 18mm SmartPly OSB3 were specified for the design and fabrication of flat pack emergency weather-proof buildings in Calais. A highly engineered, moisture resistant, wood-based panel designed for use in humid conditions, SmartPly OSB3 was the ideal choice for the emergency project as it is suitable for floors, roofs, walls and many other applications where strength and moisture resistance are paramount.

The temporary buildings were put together by Factory Settings, leading set designers within the entertainment industry. Such is the versatility of SmartPly OSB3 that the prefabricated accommodation was constructed within two weeks of the original plan being conceived. The buildings, which are designed to slot and hold together using coach bolts with wing nuts, were erected on site without tools by both skilled and unskilled workers.

Lucien Mansell, Factory Settings director commented: “SmartPly OSB was specified based on the fact it is a robust structural board with moisture resistance, which is well suited to the challenging environment the shelters are in. The project had a number of challenges such as the short timescale for the initial design-and-build, making SmartPly OSB3 the only option with a rapid turnaround required. We are delighted with the result achieved and now we are very much looking to develop the design for the next set of shelters.”

One of the aims of Greenpeace is to protect forests, hence its recognition of the environmental benefits of SmartPly OSB3 compared to plywood. As with all SmartPly products, OSB3 is made from locally sourced timber from FSC certified Irish forests which are owned by SmartPly’s parent company, Coillte.

As well as providing comfort and peace of mind to a number of displaced families at Christmas, SmartPly OSB3 presented the design team with a fully certified, sustainable product which is manufactured and tested to EN13986 and approved for use in both structural and non-structural applications.

Bob Wilson, head of events for Greenpeace UK commented: “This was an emergency situation where a number of temporary homes were needed in time for the festive season. With speed of the essence we wanted the best, most reliable versatile - and just as importantly- sustainable wood-based panelling available. SmartPly OSB3 was our immediate choice. It complies with our environmental requirements, as well as providing robust, long-lasting protection in all climates and conditions.”

(below) The Factory Settings team putting together temporary accommodation for homeless people using SmartPly OSB3

Icynene secures BBA certification

Icynene Classic, the open-celled soft, flexible, breathable foam insulation, familiar to thousands of residential installers around the country, has just secured BBA certification for applications directly to the underside of breathable and non-breathable roof membranes and felt – without the need for either a vent card or a double batten system.

Gerry Sheridan, director of GMS Insulation and Greentherm Solutions, which respectively distribute Icynene in Ireland and the UK, has been working with Icynene products in Ireland for more than twenty years. He explains the advantages of this new certification.

“First of all, when you’re applying the foam you’re full-filling the rafter area, so you’re getting 30 to 40 per cent better U-values. Because you’re applying it directly, there’s much less risk of condensation and there’s much less risk of air leakage.”

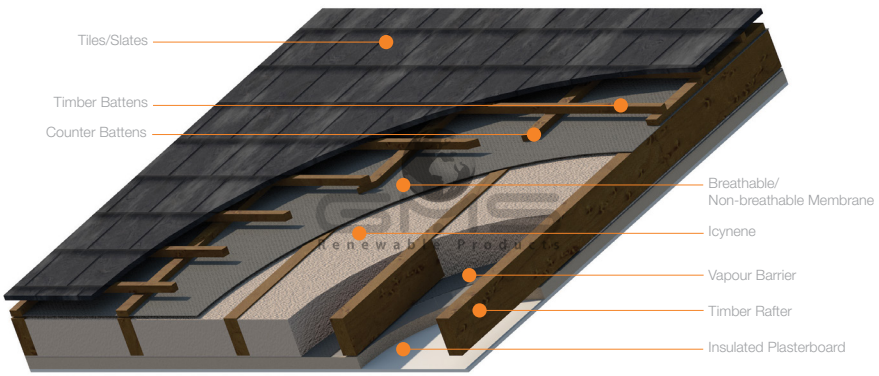
Because the application no longer requires either a vent card or double battening, labour costs are also reduced.

Sheridan explains that there are two reasons why the product has achieved this certification. Firstly, it has been tested and certified as having very low water absorption, while the product’s air breathability has also been tested and certified.

“Icynene is highly recommended for spaces occupied by people with allergies, asthma and other particular respiratory issues,” said Sheridan. “In fact, Icynene was used to improve indoor air quality as part of the American Lung Association’s ‘Health House’ program.”

Icynene – a Canadian product – is celebrating its thirtieth anniversary this year. GMS was the first European company to begin importing the product in 1994. It’s now in 20 countries across Europe and features in thousands of wide ranging projects across the country and the continent.

(below) The BBA has certified the application of Icynene insulation directly to the underside of breathable and non-breathable roof membranes and felt



News

Lime cork thermal plaster wins at Architecture Expo

Ecological Building Systems is pleased to announce that its Diasen Diathonite Evolution lime cork thermal insulating render system won in the 'best interior design' category at the RIAI Architecture Expo.

Diasen, based in Italy, have been manufacturing cork based diffusion open render systems since 1985. When thermally upgrading single leaf masonry walls, it is critical not only to install thermally efficient materials, but also to ensure that the thermal solution does not impede the ability of the wall to continue to breathe. This is particularly important when dealing with solid brick or stone walls, which utilise a lime mortar and lime plaster systems.

According to Ecological's senior technical engineer Niall Crosson, unlike many modern impervious thermal insulation systems, Diathonite Evolution is a breathable insulating plaster which provides the optimum combination of thermal performance and moisture management.

Many internal thermal insulating systems require that the existing wall be levelled with a suitable plaster prior to their application. "Otherwise uninsulated cold air pockets between the internal insulation and an existing wall can lead to significant condensation risk," said Crosson. "Unfortunately, single leaf masonry walls are often very uneven and may be difficult, costly and time consuming to level out.

On such walls a diffusion open insulating plaster system such as Diathonite Evolution presents what Ecological regard as the "perfect" solution to provide both a levelling plaster and thermal insulation in one while maintaining optimum levels of breathability and moisture management.

Diathonite Evolution is a thermal plaster based on NHL 3.5 lime and pure cork granules. "It's a natural ecological render system suitable for internal and external use," said Crosson. "The plaster system combines outstanding thermal performance with optimum vapour control and high mechanical strength." Diathonite is primarily manufactured from a combination of cork, clay, lime and diatomaceous earth. It has a thermal conductivity of 0.045 W/mk, plus high thermal mass, high compression resistance (2.7 N/nm^2), high fire resistance and excellent acoustic insulation and elasticity. It is also highly diffusion open. The raw materials used in Diathonite Evolution are natural and non-toxic.

Once the plaster is applied, it may be finished with Diasen Argacem MP highly breathable finishing smoothening plaster. Alternatively, a lime based plaster may be applied internally. Diasen's range of products have attained the quality control certification ISO 9001, the environmental certification ISO 14001, and all their products comply with CE requirements. Ecological can provide details in relation to trained installers of the system on request. For information see www.ecologicalbuildingsystems.com

(left) Pictured (l-r) are judges chair Gary Mongey of Box Architecture, Ecological's Darren O'Gorman and Peter Smith, judge Maria Kearney of Kearney Kiernan Architects

Ancon to launch new products at Ecobuild 2016

Double winner of the Queen's Award for Enterprise, Ancon Building Products continues to expand its range of high integrity structural fixings and will exhibit a number of new products at Ecobuild 2016 taking place at ExCeL, London from 8 to 10 March 2016.

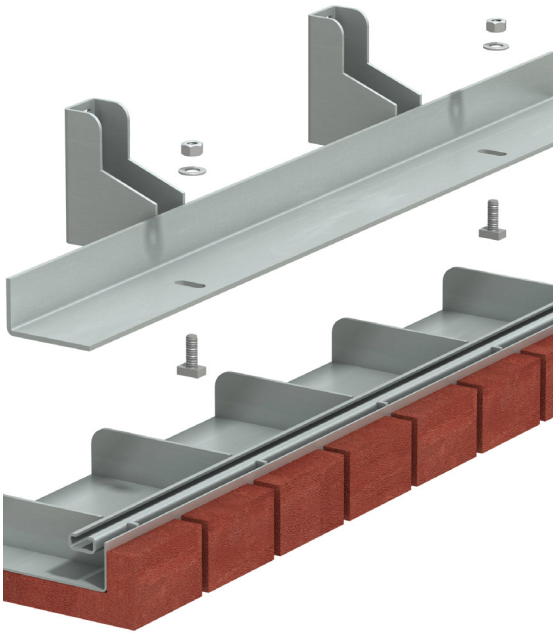
On stand number E3080, Ancon will showcase its latest fixing innovations, suitable for new-build construction including low-energy residential developments. Products on show will include the lightweight Nexus brick-faced soffit system, a number of insulated balcony connectors and an exciting new development within the Teplo range of low thermal conductivity wall ties.

Developed in partnership with cut-brick specialist Ibstock-Kevington, the new Nexus system is a lightweight simple-to-install solution to creating flawless brick soffits in any brick type. It combines brick-faced offsite-manufactured building modules with Ancon's popular MDC brick support angle. Bringing together two industry experts in one product launch, Nexus provides quick and easy alignment on site without mechanical lifting.

Further reflecting the sustainability theme of the exhibition, Ancon will also be focusing on ways of helping building designers to meet their thermal performance aspirations.

A newly-extended range of Ancon insulated stainless steel connectors enable structural integrity to be maintained at steel and concrete balcony interfaces without compromising on thermal efficiency. Designed to create a thermal break in the construction, these connectors are proven through thermal modelling to help prevent condensation and mould growth.

For exhibition visitors involved in the super-insulated end of the market, including passive house and zero carbon projects, Ecobuild 2016 will hold a special interest – the launch of an exciting extension to the award-winning Teplo range of ultra-low conductivity basalt fibre wall ties. By minimising insulation depth and wall footprint, these unique wall ties are already helping to shape low energy building design and this latest product development will see them become more user friendly for the installer, improving their all-round appeal.



(right) Ancon's Nexus system, developed in partnership with Ibstock-Kevington, will be launched at Ecobuild alongside new Teplo thermal breaks

News

Ampack receives new BBA certs

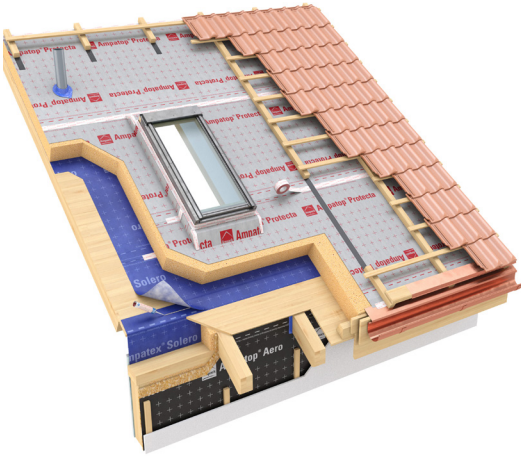
Leading airtightness and vapour control product manufacturer Ampack's BBA certification now includes the company's external systems — Ampatop Protecta, Ampatop Protecta plus, Ampatop Aero and Ampatop Aero plus. The range of associated Ampack tapes is also listed as ancillary parts in the certificate. The certificates are the second and third in a new range of certification for Ampack following the grant of BBA certification for airtight systems.

The entire Ampack range comes with a unique ten-year warranty. Ampack's guarantee covers not just the replacement cost of materials but also any associated damages and the cost of any repairs, which makes it unique in the market. This warranty is particularly pertinent as architects and engineers assume greater levels of responsibility when certifying. The use of the Ampack system can essentially provide security over the building fabric.

Established in 1946, Swiss supplier Ampack is a market leader in building envelope protection products, and was reportedly the first company to commercially produce vapour checks. As a result Ampack has products installed and tested for over 35 years. The company's product range is distributed throughout the UK and Ireland via sustainable building product supplier Partel.

"Ampack has been at the forefront of building protection systems for decades and has developed a name that stands for high quality proven products," said Partel director Hugh Whiriskey. Ampack offer one of the largest ranges of airtight and windtight systems including a range of butyl, nail seal, UV stable tapes and liquid weldable roof membrane Ampatop Seal, which has a liquid weldable surface that can be installed down to a minimum roof slope of five degrees.

(below) Ampack's range of airtightness and vapour control products are available in the UK and Ireland via Partel



Fast-drying screed from Smet: walkable in six hours

Many new build and renovation flooring projects demand fast turnarounds, from commercial and industrial projects where downtime must be minimised, to the self-builder or renovator, where home-owners simply want their floors completed as quickly as possible, allowing final floor covering. Traditional screeds require significant drying before the final floor covering can be installed, however, if this is not well planned for, it may well delay the completion of the entire project.

Smet advise the use of Sopro Rapidur B5 Rapid Drying Screed Binder, where floor completion is critical. The floor can be walked on in as little as six hours, and floor tiles laid in three days. The key to this product is not only its quick drying capabilities, but the fact that it also develops its full strength quickly, reaching 25 N/mm^2 in 24 hours. "Unlike other quick drying screeds which take the usual 28 days to achieve similar strength," said Smet director Joris Smet.

Made in Germany, Smet said Sopro Rapidur B5 Rapid Drying Screed Binder makes a "lovely workable screed. It's also got that all-important long open-time and it finishes beautifully. Applicators tell us time and again how malleable it is compared to other regular rapid drying screed binders."

Being a special polymer-modified binder specifically for use in rapid-set cement screeds, it allows early flooring installation to DIN 18 560 and BS 8204-1, and uniquely, it is particularly suitable for use with underfloor heating. Smet said the screed is easily laid to falls, and is pumpable too.

Sopro Rapidur B5 Rapid Drying Screed Binder is suitable for use on heated screeds, bonded screeds, unbonded screeds, screeds laid on the insulation layer and for floating screeds. Smet said the company's trained and supported partners site-mix the Rapidur B5 binder with 0–8mm gravel sand, producing particularly economical high-strength, rapid-set cement screeds. It's also suitable for producing grade CT-C60-F7 cement screeds to BS EN 13813 and, depending on aggregate quality and mixing ratio (sand/Rapidur B5/water), higher-grade screeds can also be produced. Placed screeds incorporating Sopro Rapidur B5 are ready for tiling after approximately three days and ready to receive natural stone finish after around five days.

(above left) The Sopro Rapidur B5 fast drying screed binder, available in the UK and Ireland via Smet, was used in the renovation of Frankfurt Railway Station

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News

Government decision to cut energy company obligation "scandalous"

The Association for the Conservation of Energy (Ace) has described as "scandalous" the Chancellor's announcement of a 42% cut in the help available to households living in "dangerously" cold homes. The association has also expressed disappointment that, despite allocating £100 billion for infrastructure projects, Mr Osborne has "chosen to spend not one penny of this pot to make the UK housing stock more energy efficient".

Jenny Holland, head of Ace's parliamentary team, said: "The appalling state of our housing stock is one of the key causes of excess winter deaths, which today's figures show surged last winter to their highest level in 15 years." An estimated 43,900 excess winter deaths occurred in England and Wales in winter 2014/15.

Holland continued: "Yet despite this, the Chancellor has today ignored industry-wide pleas to release infrastructure funding for an energy efficiency programme. Instead, he has announced that the energy company obligation (Eco) – the only remaining help for householders living in cold homes – will be slashed to £640m a year from 2017, a drop of 42% on annual Eco spending to date.
"The chancellor boasts that households benefitting from the Eco are expected to save £300 on their bills. But these lucky few will amount to just 200,000 per year. The other five million poorest households who struggle with their basic living costs won't even get a look in until April 2022."

In addition, while welcoming the proposal to build 40,000 'affordable' homes by 2020, Ace said that having ditched the zero carbon homes standard earlier in the year, the chancellor has "needlessly saddled these homes with higher running costs – or householders will be forced to have expensive and messy retrofits at some later stage to bring their homes up to scratch.".

Jenny Holland continued: "Meanwhile, the chancellor has again shown a willingness to adjust stamp duty as a policy lever, increasing it by 3% for buy-to-let purchasers. But he has once again failed to incentivise energy efficiency investment by introducing a revenue neutral adjustment to stamp duty based on homes' energy performance."

(above) Former energy minister Ed Davey visiting a council house that received external insulation & heating system upgrade under the Energy Company Obligation (Eco) scheme in March 2015

Penny Randell appointed director of Ecological Building Systems

Penny Randell has been appointed as a director of Ecological Building Systems UK Ltd. Randell was invited to join the board of directors after six years with the company, which under her management has progressed from being based in her home to its current location near Carlisle in Cumbria with a team of staff, offices and extensive warehousing for its products.

Ecological Building Systems is renowned for its research into sourcing products throughout Europe that help create diffusion open, healthy buildings. The company was established in Ireland in 2000 and the UK Company was established in 2006. It is now the sole agents in the UK and Ireland for a host of products, which include: pro clima airtight and windtight products, Gutex wood fibreboards, Calsitherm Climate board, Thermo-Hemp & Thermo-Jute Insulation, Diasen thermal cork plasters and Elka structural boards.

The company's products have been used in numerous high profile low energy and passive house builds throughout the UK as well as in mainstream building. As well as supplying products, the company offers significant technical input into projects and Randell has ambitious plans in the future to develop a Cumbrian hub of ecological building excellence where builders and home owners can upskill in both insulation refurbishment and achieving airtightness in buildings.

Randell said: "I am delighted to become a director. I joined the company to develop the UK market in 2009 and we've seen significant growth over the last 6 years which has culminated in developing a team and facilities here in Cumbria. The whole team has been pivotal to our success and we are looking forward to further expansion and growth in the future as the market expands for low energy, sustainable building."

(left) Ecological Building Systems UK director Penny Randell

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Time for passive house designers to address hot water demand

Passive house is the most rigorous building standard in the world for cutting energy use from space heating, but it pays hot water demand much less attention. With hot water being responsible for an ever greater proportion of energy use as buildings become better insulated, it's time we tackled this major source of carbon emissions, argues Cath Hassell of ech$_2$o consultants.

While the passive house standard could be a major part of the solution to reducing the 50% of CO_2 emissions that come from buildings in the UK, I want to look at the 6% of CO_2 from using hot water in homes and ask why passive house isn't doing more to reduce this demand. After all, as you improve the building envelope, domestic water use becomes an ever increasing proportion of the energy load.

The 'average' house in the UK (a 100 m2 semi with an occupancy figure of four) uses 20,000 kWh of energy for hot water and space heating a year – 16,000 kWh for space heating and 4,000 kWh for hot water, so a 80-20 split. By building to the passive house standard of 15kWh/m^2/year we reduce the space heating demand by 90% — an impressive result and one for which passive house is rightly applauded.

But in the absence of considering hot water consumption, we have a situation where the energy demand for hot water is almost three times that for the space heating and the overall heating and hot water demand has reduced by 72% rather than 90%.

Even if renovating to the Enerphit standard with its requirement to reduce space heating to 25kWh/m^2/year, or the AECB silver standard of 40kWh/m^2/year, hot water use is still more than, or equal to, the space heating demand.

Most hot water use in homes is from bathing, with showers now more popular than baths. In the UK 25% of total household water use is for showers with the average shower lasting 7.5 minutes. In England and Wales the 2015 version of Part G of the Building Regulations addresses water efficiency and sets a maximum flow rate from showers of ten litres per minute (hardly a water efficient flow rate) unless local planning laws require the lower level of eight litres per minute.

Water efficient taps, shower heads, baths etc. are eclipsed by the opposite in the market place. And, of course Part G is only for new buildings so when renovating — even to the Enerphit standard — there is no need to reduce shower flow rates and the sky's the limit. Thirty three litres per minute from your shower anyone?

The privatisation of the water industry in England (and Wales) in 1989 has led to a fractured situation with (up until now) little cross company collaboration to spread national (or even regional) messages about the importance of saving water. The water companies supported the setting of water efficiency standards under Part G, because they are acutely aware of the pressure on water supplies. But their messages are restricted to localised advertising within their specific areas, and rarely makes the link between hot water use and CO_2 emissions.

In Wales, Scotland, Northern Ireland and the Republic of Ireland at least the water supply is still (mostly) centrally controlled but I have seen little concerted push to reduce hot water use. So we are pretty much stuck with the four minute shower challenge and desperately need a national campaign to target hot water use.

In Ireland, as all new dwellings have to have some sort of renewables fitted, solar thermal is often specified which is to be welcomed as it will reduce the amount of hot water demand from fossil fuels. But in the UK, although there is support for solar thermal under the Renewable Heat Incentive (RHI), with a yearly return of £290 - £390 against an installation price of approx £4000, it hasn't kick-started the industry yet. Wastewater heat recovery mechanisms on the other hand are going into most new speculative build developments in the UK because volume house builders have realised the positive effect per pound spent on this technology has on the SAP rating of the dwelling. But I rarely read that one has been installed into a passive house. Indeed I rarely read anything about the water specification in UK homes built to the passive house standard, bar the occasional solar thermal system. In fact I probably more often read that the property has an immersion heater to heat the hot water, but with no corresponding information relating to the effect this would have on CO_2 emissions or what type of water efficiency appliances have been specified.

Of course passive house does consider hot water use. PHPP predicts 3.5 kWh is required per day for hot water and it is argued that for a passive house dwelling in the UK the figure will be higher at 4.6 kWh/day. But I would argue that this enhanced figure is still too low. Taking a shower with a flow rate of eight litres per minutes for 7.5 minutes, once a day, requires 57 litres of hot water. With every litre of hot water for a shower requiring 0.039 kWh of energy, the shower requires 2.2 kWh of energy. Over a year that is 803kWh or 8 kWh/m^2/year in our 100 square metre property. And remember this is for one person for one shower. There is still the other hot water use to consider. And, although energy (but not CO_2) requirements for an electric shower are less, it is still 511kWh or 5 kWh/m^2/year in our 100 square metre property.

The passive house concept is sold on excellent comfort conditions as well as reduced bills, with the question often asked "who wouldn't want to live in a passive house?" But my question is: "Who wouldn't want to save the polar bears?" And by reducing hot water demand in our homes we can contribute to exactly this. Relying on just Part G or the water companies is the wrong approach. Passive house designers should be specifying wastewater heat recovery or solar thermal as well as reduced flow rates from showers and taps into all their designs.

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International Selection

This issue's collection of inspiring international passive houses includes a striking Black Forest family home, the world's first 'passive house premium' building, a deeply ecological Canadian house, and a New York tower that's set to be the world's tallest passive house.

Passive House M, Black Forest, Germany

This stunning passive house is set in Haiterbach, in the middle of Germany's scenic Black Forest. Designed by M3 Architekten, the building's north side is relatively closed, while the south side is fully glazed and adapts to the sloping terrain. The house's clean and cantilevered design draws heavily on modernist architecture. The solid elements are clad in simple white panels or timber, with the whole building tied together via a black "ribbon". All interior rooms are oriented in the direction of the adjacent valley, providing sweeping views over the surrounding farmlands and forests, but also offering privacy from neighbouring properties.

The 315 square metre house, finished in 2010, was constructed with aerated concrete blocks that were externally insulated with mineral wool. It boasts airtightness of 0.4 air changes per hour, plus a large solar thermal array which can deliver heat to the ventilation system, and a wood pellet stove. The house also has extensive green roofs, and a 1000 litre tank that stores rainwater for toilets and gardening. It's all one of the best-looking passive houses that we've ever seen here at Passive House Plus. ▶

Photos: Daniel Stauch

Cornell Tech passive house tower, New York City, USA

Handel Architects' planned residential tower for Cornell University's new Roosevelt Island Campus is set to be the world's tallest passive house building. The 26-storey building is part of Cornell's 2.1 million square foot technology campus in New York City, a partnership between Cornell and Technion-Israel Institute of Technology. The building is being developed by Hudson Companies, Cornell University and the memorably named Related Companies.

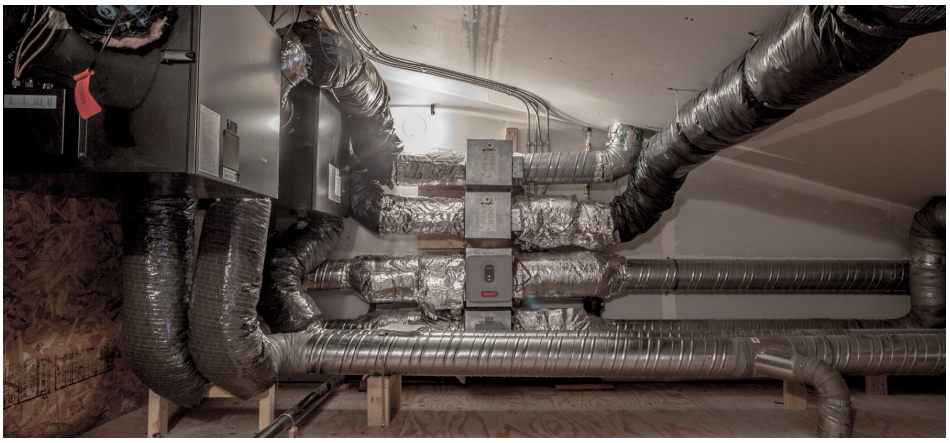
The facade, constructed of a prefabricated and airtight metal panel system, will act as a thermally insulated blanket wrapping the building structure, along with triple-glazed windows. At the southwest facade, facing Manhattan, the exterior opens to reveal a louver system that extends the entire height of the building. This reveal is designed to be the gills of the building, literally providing an enclosed, louvered exterior space where the heating and cooling equipment live, allowing the building system to "breathe".

Images: Kilograph, Weiss/Manfredi and Handel Architects

Purified fresh air will be ducted into each bedroom and living room through the MVHR system. Low VOC-paint will be used throughout to maintain high air quality. And compared to conventional construction, the building is projected to save 882 tons of CO_2 per year.

The new structure will be the tallest building on Cornell Tech's campus. The tower's exterior will shimmer, using a state-of-the-art, colour-changing paint that, when reflecting light, naturally shifts in colour. Meanwhile, the interior is designed to provide a comfortable living experience that reinforces the social and intellectual connectivity that is at the heart of the school's mission. The building also features a number of collaborative spaces, both inside and outside, to facilitate collective academic creativity. ▶

Photos: Shamit Sthankiya



South Surrey passive house, British Columbia, Canada

This innovative prefab passive house building in South Surrey, British Columbia, was completed in 2013. Both the roof and walls were constructed from a prefabricated double-stud wall with mineral wool insulation, with taped-and-sealed OSB providing the airtightness. The house features triple-glazed Optiwin windows, mechanical ventilation with heat recovery and thermostat-controlled electric heaters in each room. There's also a solar hot water system and a high efficiency gas fireplace. The family's current electricity bill is just $60 a month, with most of this generated by regional hydroelectric power, and according to the architects Marken Projects the heating has not been turned on since the house was occupied.

What's more, the client's desire to have three generations living under one roof drastically reduces their own carbon footprint as a family. The house boasts a swathe of other green features too: low water flow fixtures, drain water heat recovery, native landscaping, locally sourced and recycled construction materials, and VOC-free construction, making it one of the most ecological homes we've come across in a while. And with airtightness of 0.6 ACH, space heating demand of 13 kWh/m^2/yr and a heat load of 9 W/m^2, it ticks all the key passive house boxes too. ►

Want to know more?

Click here to view additional information on these projects, including an online gallery featuring illustrations, photographs, and project overview panels.

This content is exclusively available to our digital subscribers.

Photos: Markus Meyer, Airoptima

House of Energy, Bavaria, Germany

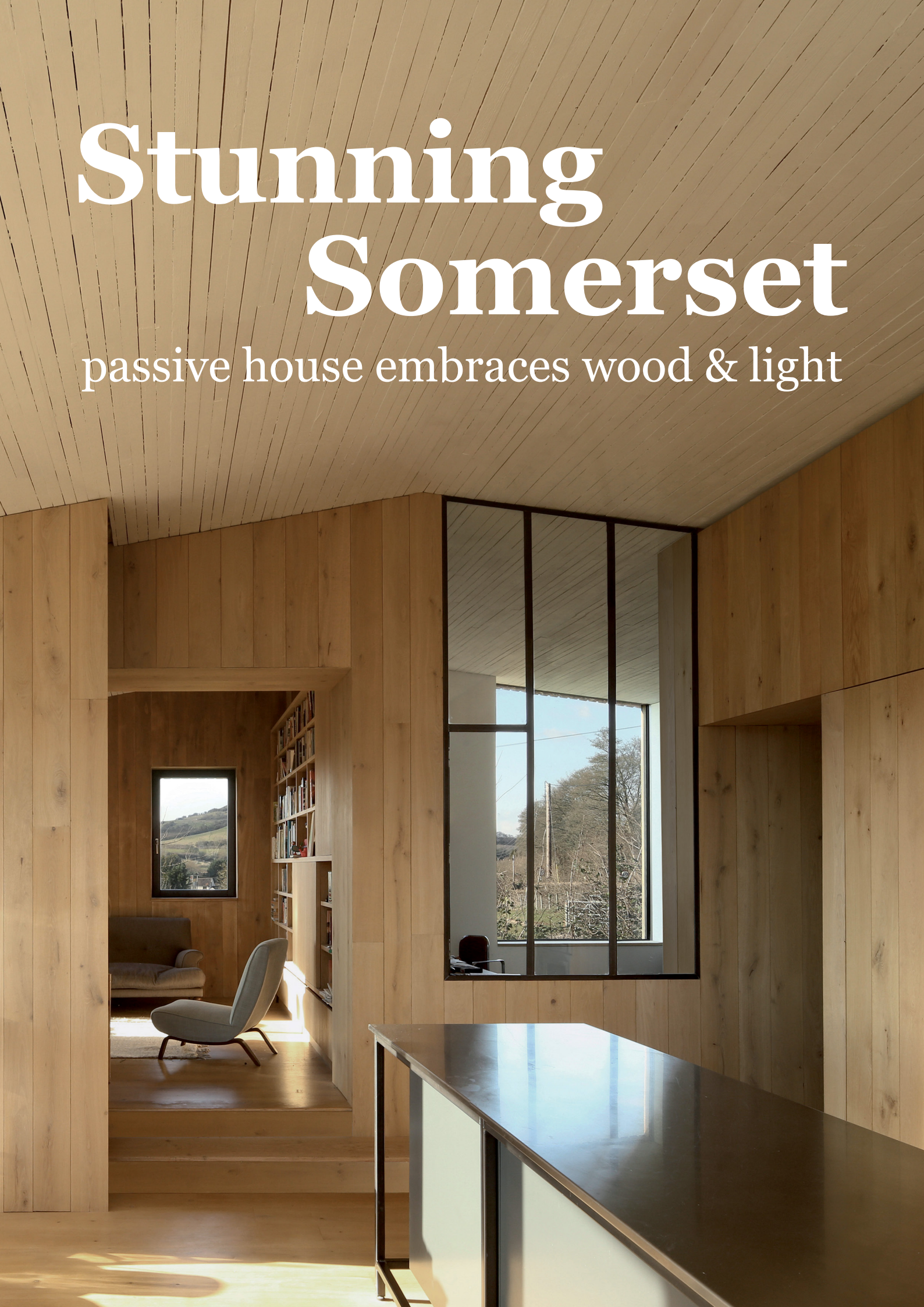
This mixed residential and commercial project in the town of Kaufbeuren is the first building in the world certified to the new 'passive house premium' standard. The certificate was presented to the building's owners at a special event during the International Passive House Days last November. This new certification category, launched earlier in 2015, rewards passive buildings that produce more than 120 kWh/m²m/yr in renewable energy. House of Energy achieves this via a huge 250 square metre solar photovoltaic array on its roof.

The project was developed by the building services company Airoptima, which now has its headquarters in the building. The building also houses the operations manager's flat, a training centre, and a permanent exhibition on the topic of construction and refurbishment.

The House of Energy was designed by BG Architektur and certified by leading passive house certifier and consultant Herz & Lang. The three-storey building was constructed from masonry block and insulated externally, and scored an impressive airtightness test result of just 0.2 air changes per hour. A ground-source heat pump is used for the remaining small heating demand and hot water provision. The necessary auxiliary energy and domestic electricity is provided by the photovoltaic system. Any surplus energy that is generated is fed into the grid.

Stunning Somerset

passive house embraces wood & light



Photos: Graham Bizley

This inspiring rural passive house, designed by architect Graham Bizley and his wife Emily, is first and foremost a striking piece of contemporary architecture that enhances its scenic location

Words: Ben Adam-Smith

In a self-build couple there are normally skills to leverage. With Emily and Graham Bizley the worlds of interior design and architecture have come together, exactly as one might hope, into a building whose inside feels like it belongs to the outside and almost blurs the distinction between the two. In the same way Dundon Passivhaus, their family home for the last three years, harmonises with its environment and gives the impression it's been there far longer.

In some respects this project began when Graham and Emily first met, because Graham had completed the design of a small self-build in London, which was soon to become Emily's home too. Graham jokes that with Emily forced to live in his bachelor pad, the discussion of what they could build together began. The one-bedroom property may have worked for a couple but years later when thoughts turned to starting a family, their priorities changed, and they wanted more space and to bring up their children in the countryside.

Having bought land at auction for his first build, Graham knew that things could move quickly; and he was right. No sooner had they sold their London home to release capital and started renting, than they discovered a makeshift bungalow from the 1920s with incredible views of the Somerset Levels. Facing southeast, the plot had good solar access for the passive house they desired, so they put in a bid and bought it.

Graham, a director at Prewett Bizley Architects, had worked on several pioneering low energy retrofits, which although not down to passive house level, had given him an appreciation for the standard.

Graham explains: "Terms like 'green' and 'eco' don't really mean anything. They're a statement of good intentions obviously, but in terms of actually measuring what you're achieving and having some means of quantifying how much you need to do, passive house actually gives you a way of doing that. It gives you a standard to aim for based on building physics and actual science. So I think that's why it was attractive."

Interior designer Emily took a little longer to come around. She remembers: "I was quite skeptical to start with and Graham had to convince me. He used to call me 'passive spouse' because I was just a bit like, 'really?' I felt that everything that we had to do to make it passive was taking budget away from all of the things that I wanted to do! But the reality is that the way the house looks is a product of being a passive house."

In spite of being the architect in the relationship, Graham stresses that the house design was a joint effort that evolved over time. He reflects back to a holiday in the Alps: "I remember sitting in Switzerland in a mountain refuge at the end of a long walk and we were sitting by a fire in a wooden room thinking, wow, this is what our snug should feel like. ▶

So we had all these ideas from beforehand which we very much developed together."

Sense of place was a central theme for this country house because the plot is adjacent to an ancient apple orchard and looks out onto agricultural land. Graham says: "A lot of houses that are built in rural areas are effectively suburban houses and that's why one of my main campaigns is against the suburbanisation of the countryside." This build aimed to enhance its site with a home that would blend well into its context. After all, their nearest neighbour was a Dutch hay barn, a working building from which they drew inspiration.

The constraints of the plot, a sloping site of around a quarter of an acre, dictated a fairly compact form if they wanted a garden. Planning was relatively straightforward, aided by Emily and Graham's decision to keep the new house at roughly the same height as the original bungalow. That meant to afford the space they desired they had to dig into the hillside. It's actually single storey on one side and two storeys on the other, which they did to avoid the feeling of being underground.

As they were not on a rock-bottom budget, Graham was keen to push the envelope of the building.

He comments: "A lot of passive houses can be not the most attractive, not the most architecturally inspiring houses. Partly because if you just follow the maths, if you follow the calculations, they tend towards a box shape and without very much articulation on the outside it's quite difficult to fix things through the walls, so things like verandas and canopies and balconies are difficult to do. You have to detail them really carefully. You end up with a lot of windows on the south side and not much on the north side so you can end up with some pretty blank, difficult elevations."

At about £1700 per square metre, the extra budget went into the balcony/veranda structures, the finishes, the materials and the generosity of space. The house has a soft wood timber frame, made of spruce, but to achieve the level of insulation it's a twin timber frame (with a total thickness of 340mm). The inner frame bears the load and the outer frame, which is hung off the inner frame on plywood gusset plates, provides ▶

thermal separation. Warmcel insulation was then blown into the space.

The exterior is clad in green oak and there's an outrigger structure of green oak posts. The loggia works well with the energy strategy because it provides solar shading to the windows while tying in the barn's exposed structure. Viewed from below, the oak posts mirror the straight Corsican pines on the hill above.

The indoor/outdoor relationship has not been left to chance either. Each internal space relates outside either to a terrace or to a part of the garden, and windows of differing sizes frame specific aspects of the view, such as a line of willows or even telegraph poles, rather than blatantly revealing the entire panorama. They also thought carefully about the spaces with some open, some enclosed, and a lower ceiling height in the snug to make it cosier and higher ceiling heights reserved for the master bedroom and kitchen dining space. Another characteristic of the house is internal glazing, which gives a strong connection between the rooms visually.

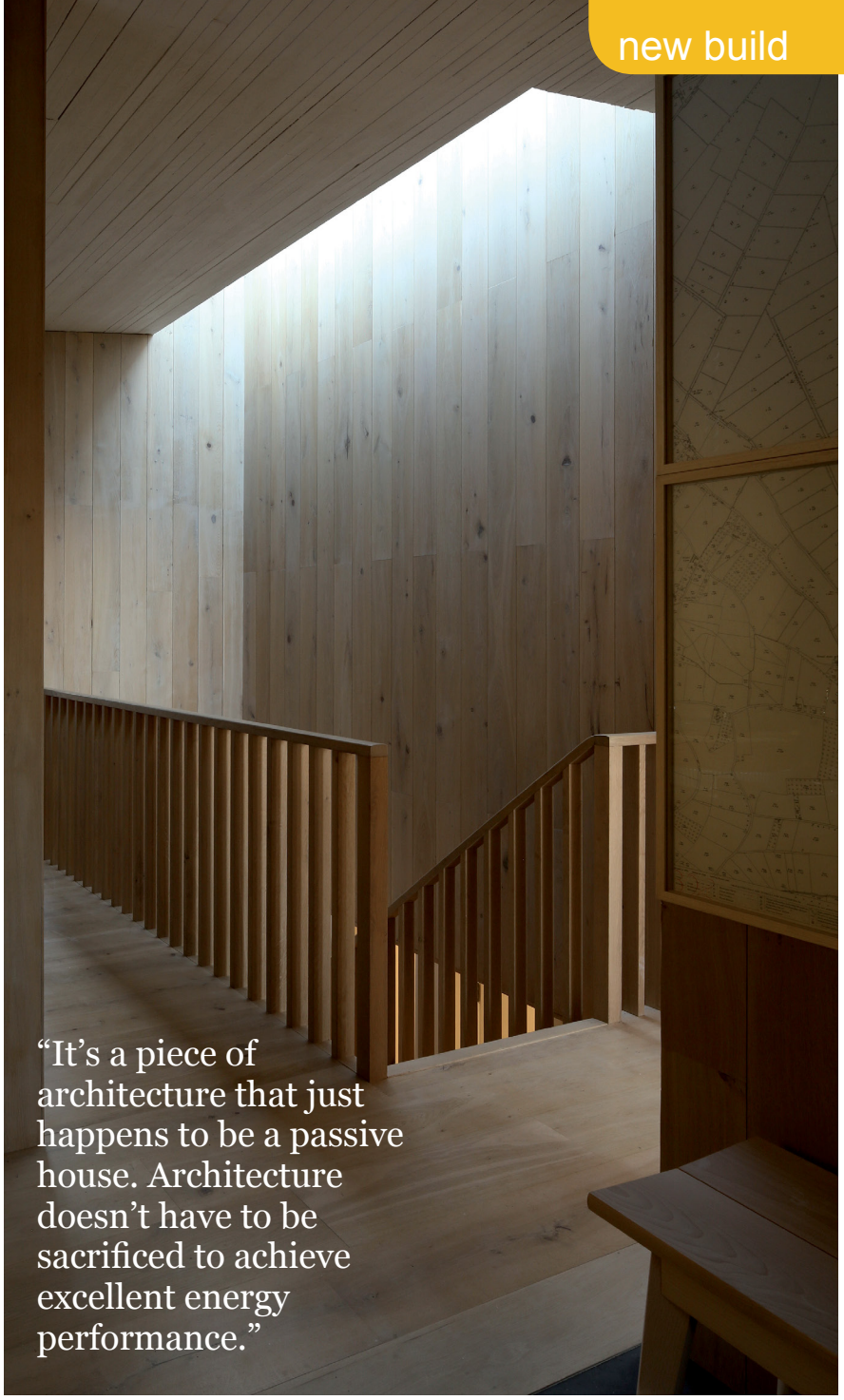
With no main contractor on this project it has been a self-build in its truest sense. While subcontractors were brought in for the groundworks and roofing, Graham and Emily can stand back and marvel in what they've achieved. Graham worked full time on site for a year and a half tackling a wide range of tasks, from carpentry and airtightness taping to installing the MVHR system and more.

Emily continues: "We've designed all the furniture ourselves, like beds, the kitchen table, the kitchen, well in fact everything. Boot room cupboards . . . But also making things that really fit with the house. We haven't just gone out and bought it in a shop. I think that's quite important to the atmosphere of the house."

For aspiring self-builders, perhaps most remarkable is how they have emerged intact from their toils and do not rule out another project down the line.

As they finally sit back and relax, it is the air quality that impresses Graham: "It's never stuffy or foisty or condensationy or mouldy or any of those things. That's the thing I like most about passive house, I think."

The comfort and evenness of temperature is something Emily adores. Reflecting on the project the biggest challenge in achieving passive house was really one of endurance. Graham took on tasks such as airtightness ▶



taping as a learning experience, but it was laborious.

He adds: "I wouldn't like to guess how many pieces of tape there are in this house —10,000 or something! And it was just an incredibly onerous process. I'm interested in finding a more monolithic form of construction."

No monitoring has been carried out so far but space heating from the wood burner in the snug costs between £200-£250 and electricity is £800 per year (which also takes into account their home office). Their house has that rare quality of looking and feeling together. It was also shortlisted for last year's UK Passivhaus Awards.

As Graham points out: "It's a piece of architecture that just happens to be a passive house. Architecture doesn't have to be sacrificed to achieve excellent energy performance."

Want to know more?

Click here to view additional information on these projects, including an online gallery featuring illustrations, photographs, and project overview panels.

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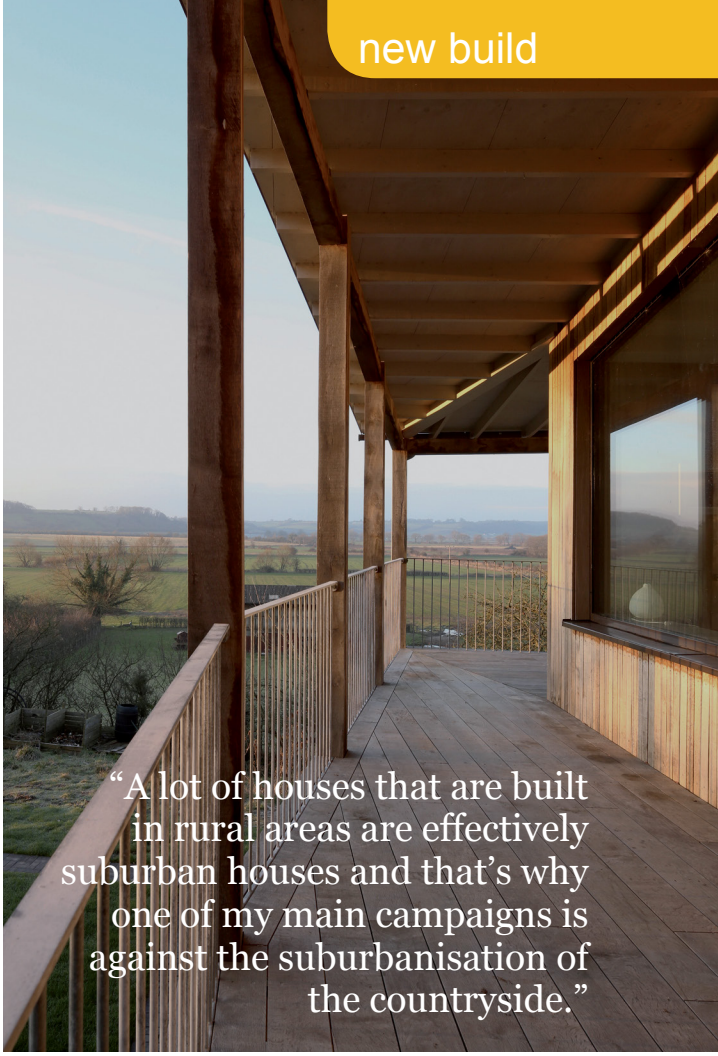
SELECTED PROJECT DETAILS
Client & main contractor: Graham & Emily Bizley
Architect: Prewett Bizley Architects
Structural engineer: Structural Solutions
Passive house certification: Warm
Ecologist: Gould Ecology
Timber frame: Allwood Timber Construction
Roof & wall insulation: Warmcel
Roof & wall insulation installer: Tinhay
Airtightness tapes: Pro clima and Siga
Internal linings: Fermacell
Ground floor insulation: Pavatex
Internal insulation: Black Mountain Natural insulation
Windows & doors: JPW Construction
Folding sliding doors: Solarlux
Folding sliding door installer: Interlux
Rooflight: Vitral
Rooflight supplier & installer: Metal Solutions (SW) ltd
Electrician: DJM Electrical
Plumbing: GP Davis
Stove & thermal store supplier: Stovesonline
Solar, thermal store and boiler stove installer: 1 World Solar
MVHR: Green Building Store
MVHR ductwork: Lindab
Sewage treatment plant & rainwater storage tank: Marsh Industries Ltd ▶

(top) the house was built into the hillside with a retaining wall to keep to the height of the original bungalow, so the dwelling is single storey on one side and two storeys on the other; (above) the house is twin timber frame construction, the inner frame bears the load and the outer frame provides thermal separation. Warmcel insulation was then blown into the timber frame cavity; (right) the exterior is clad in green oak and there's an outrigger structure of green oak posts, with this outer structure providing solar shading to the windows



"A lot of houses that are built in rural areas are effectively suburban houses and that's why one of my main campaigns is against the suburbanisation of the countryside."

PROJECT OVERVIEW

Building type: Detached 203 square metre (total floor area) rural timber frame house

Location: Compton Dundon, Somerset

Completion date: 2013

Budget: £475,000

Passive house certification: Certified

Space heating demand (PHPP): 14 kWh/m²/yr

Heat load (PHPP): 10 W/m²

Primary energy demand (PHPP): 120 kWh/m²/yr

Airtightness (at 50 Pascals): 0.6 air changes per hour

Ground floor: 20mm t&g engineered oak floor boards, on 40mm wood-fibre insulation, on 200mm reinforced concrete raft slab, on 250mm EPS insulation, on 50mm sand/cement blinding, on 150mm compacted hardcore. U-value: 0.12 W/m²K

Walls: 20mm green oak cladding, on treated softwood battens and counter battens, on breather membrane & 9mm Panelvent sheathing board, on 340mm Warmcel insulation between studs (twin softwood timber frames, outer frame hung off inner frame to avoid thermal bridges), on 15mm OSB sheathing with taped joints (airtightness layer), on 50mm softwood battens forming service zone with hemp insulation between battens, on 12.5mm Fermacell internal lining. U-value: 0.12 W/m²K

Roof: Standing seam metal roofing, on 18mm WBP plywood deck, on treated softwood battens forming ventilation zone, on breather membrane + 9mm Panelvent sheathing board, on 356mm Warmcel insulation between studs, on 15mm OSB sheathing with taped joints (airtightness layer), on 50mm softwood battens forming services zone with hemp insulation between battens, on 20mm softwood board internal lining. U-value: 0.11 W/m²K

Glazing: Sigg PassivhausVenster triple-glazed timber-framed aluminium clad windows. Passive House Institute certified. U-value: 0.85 W/m²K. Solarlux triple-glazed sliding door & Vitral triple-glazed roof window.

Heating system: Primarily MVHR pre-heated supply air. Also Normatherm wood burning stove. Four square metre solar thermal array with 1000 litre Akvaterm solar thermal store.

Ventilation: Paul Novus 300 Passive House Institute certified mechanical ventilation with heat recovery (MVHR) system, 93% efficiency (PHI).

Green materials: Rainwater harvesting from roof with 4500 litre storage tank below garden.

The Isle of Wight is a pretty rural island, and preserving its attractive environment is important to residents, not least because it helps to bring in the island's many tourists. However, for a number of years now the island's environmental ambitions have been global as well as local. In 2008, the Isle of Wight Council signed up to the ambition for the island to have the lowest carbon footprint in England by 2020.

When Southern Housing decided to redevelop a 1.5 acre site on the island to create new and much needed affordable homes, the council translated words to action by giving financial support to enable the landlord to build the homes to the passive house standard.

Southern Housing had always wanted to use a fabric-first approach for the 16 houses and 12 apartments, because the approach offers high environmental performance while also benefiting residents by giving them significant and long-term savings on their energy bills.

However Southern Housing was also aware of the Zero Carbon Hub's reviews into the real-life performance of low energy buildings. "In terms of their energy use, air quality and thermal comfort, these reviews found that the benefits of the design intended didn't appear," Southern Housing development manager Andrew Hulmes explains. Passive house was chosen to avoid this performance gap, and ensure that residents would have running costs that were genuinely low.

"Our initial estimation is that by building to passive house the scheme could altogether save up to £25,000 a year in energy costs,

Isle of Wight *development goes passive against the odds*

This new development of 28 units brings affordable passive housing to the Isle of Wight, bolstering the island's bold eco ambitions while embracing a traditional seaside aesthetic

Words: Kate de Selincourt

with some residents being able to save up to £900 in a three-bedroom home."

Passive house also removed the need to provide expensive renewable technology to meet sustainability goals. Local authorities often encourage — sometimes even require — communal heating using CHP or biomass in larger schemes, but Southern Housing were clear that they wanted the fabric to do the work. As Andrew Hulmes explains: "Doubts about the use of micro-renewable energy technologies had arisen. Based on our experience, high management costs around central boiler systems neutralise any energy efficiency savings.

"But the Isle of Wight Council was fully receptive when we presented our plans to build passive house homes and actively supported our approach, delivering funding to cover the additional cost in line with the island's sustainable development strategy, 'Eco Island'."

The new development still needed to respect the rural surroundings however – even though some of these considerations complicated the drive to slash heat demand and achieve passive house.

As Andrew Ogorzalek, director of PCKO, the scheme's architects, explains: "The main challenge was [getting the] design to fit into the locality. We wanted to retain the distant views and a permeable look, in keeping with the setting, which is mainly detached houses in gardens. Terraces would have been more economical and would have made it easier ▸

to achieve passive house, but would not have been quite right, so instead we have pairs of semis that resemble detached houses."

The forms of the individual buildings are not as simple as they could have been, featuring double-pitch roofs and flat-roofed sections: "The mass of the houses is broken into smaller elements to fit the scale of the surrounding buildings," Andrew Ogorzalek explains.

There is no doubt that a form like this makes achieving passive house more challenging than a terrace, or even than semi-detached houses with a more simple form, and PCKO worked closely with passive house consultants Warm to ensure the energy targets were met.

"Our initial estimation is that by building to passive house the scheme could altogether save up to £25,000 a year in energy costs"

"The form was a challenge. We would have preferred terraces, which are a much more efficient form," Warm's Karl Parsons agrees. "In fact these are the third iteration of the houses; the first designs we saw were less optimised, so we went back with suggestions."

However the architects' original intention was preserved through the iterations. Parsons continues: "The houses vary from a form factor of 3.2 to 3.7; these figures are certainly far from what we'd usually aim for, but we were working within quite a specific design aesthetic that the architects felt to be appropriate for the location.

"We worked the design hard, we had to. We had to push the thermal performance as far as we could, squeezing the U-values of opaque elements, choosing doors and windows from separate suppliers to maximise the performance of each, ensuring MVHR duct lengths were kept to an absolute minimum. I like to leave a wider margin of safety under the space heating demand targets; they had to be narrower than usual."

Parsons adds that although they did not have the benefit of PHPP9 for this design, it might have made the design easier — Warm have found the new software really helpful on another scheme involving small units with high occupancy, as is characteristic of social housing in the UK.

The Cameron Close units feature cathedral roofs, with skylights over the stairwells, bringing in extra natural light to help save on electricity and provide rapid purge ventilation in hot weather.

Skylights over stairwells are not always popular with contractors, who will have to be working at height over a void. However the team from Stoneham Construction, who carried out the build, took it in their stride. "It's fiddly, because you end up with a scaffold tower that's then in everyone else's way, but it isn't difficult," says site manager Nigel Meaden.

And the effort was worth it, Andrew Ogorzalek believes: "These have ended up being one of the most-liked aspects of the design." He adds: "The builder was very good, very diligent with the principles of building to passive house."

Karl Parsons's former colleague at Warm, Jon Trinick agrees — he says that when a passive house is complicated or close to the margins of compliance, success is more dependent than ever on the quality of construction — "and the contractor helped by being awesome."

At Cameron Close, the units are constructed from thin-joint blockwork, an option chosen by the contractor. Fortunately external insulation with render was not a planning issue in this instance because the island has quite a characteristic 'sea-sidey' aesthetic, with little exposed brickwork.

"We went for a masonry construction as we could parge the inside which made it easier to reach the airtightness target," Meaden explains. "Our bricklayers had never used these particular blocks, but had training from manufacturer H+H to get them underway. Once the build got going, the team embraced it and enjoyed using it as a system."

"There is an accelerant in the mortar which means you can lay more courses at a time. The mortar goes off in 15 minutes so you can just keep building, and are not restricted to a particular amount in a day.

"You do have to be more accurate with the setting out, you have to get the bottom course spot on — but then it is hard to go wrong. With the thin joints you get a really accurate build, there is a band saw to cut the blocks which gives a perfect finish — this is very helpful in a passive house build where everything needs to be so precise."

Although the overall glazing on the houses is not the kind of extravagant overheating-waiting-to-happen seen in some high budget builds, the risk of overheating from summer solar gains did have to be carefully considered, not least because the Isle of Wight is one of the sunniest places in the UK.

The windows are quite tall, and this makes it harder to shade them effectively with brise soleil – they would have had to be about one metre deep to be effective, which was not realistic.

Instead the design team opted for sliding shutters. "Shutters brought their own complications; there is a risk of thermal bridging with mountings, and as they were inset to lie flush with the render, there is less insulation behind them – there's always something to think about," says Karl Parsons. ▶

"We don't usually use shutters because contractors are not that keen on installing them but they can be more effective, especially where east/west gains are an issue, as on some of the windows here. And I must say, they do look nice on these buildings."

It remains to be seen whether the residents use the shutters as intended. In other passive house projects it has been observed that shutters are sometimes used more for privacy than for summer shading; if left closed during the heating season this would tend to hinder rather than help the thermal performance by blocking out winter solar gains.

However Warm are remaining involved post-occupancy, to carry out monitoring for Southern Housing, who want to find out how much energy residents are using, and explore how this fabric-first approach can be replicated in future schemes.

"This means if we find residents are having teething troubles, hopefully Southern and ourselves will know and be able to discuss how to live in the homes, and deal with issues as they arise," says Parsons. Hopefully the tenants won't be getting upset, and we will be getting useful data."

Warm have already run staff sessions for the maintenance and customer care teams, introducing them to passive house, and in particular explaining how to use the MVHR.

Excluding infrastructure, external works and prelims, the build came in at £1,333 per square metre. There was an estimated additional capital cost of about 7% (about £10,000 per unit) that related directly to passive house, which was covered by the Isle of Wight Council.

Southern Housing says these figures represent a 9% increase over Code 4 and 20% over England's building regulations: "Cameron Close was always going to be built to a higher specification, even before we decided to build to the passive house standard," Andrew Hulmes explains.

The result is something that everyone is very pleased with. "The quality of the homes is very high due to the attention to detail given both to passive house design and construction," Hulmes says. The development is now part certified, with the remainder pending.

Although terraces would have been easier — and possibly cheaper — to build, this doesn't mean the consultants at Warm feel it was wrong to build these houses the way they did. Karl Parsons' former colleague Jon Trinick, who did a lot of work on the design before Karl took over, comments:

"At one extreme, passive house developments can be driven by cost-effective compliance with the passive house standard — depending on their vision, this may require significant compromise from the architect.

"At the other extreme, the architect may have a strong vision for the site and buildings that is at odds with a cost-effective passive house solution, and the energy consultant must compromise. This was the case with Cameron Close."

Jon Trinick adds that some people had been concerned that Cameron Close, by not embracing the most cost-effective building forms and completely optimised glazing, might be dangerous to the adoption of the passive house standard and the perception of its affordability. However, he disagrees:

"It shows what is possible — it shows the extreme of what can be achieved in terms of a housing association building passive house certified houses with an architect who sticks to their vision for the development."

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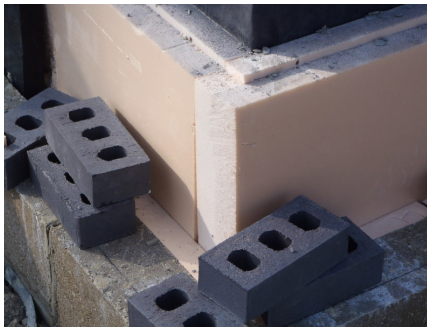

(above left) the units are constructed from Celcon thin-joint blockwork, and this enabled the walls to be built very quickly as the mortar starts to set within 15 minutes; (above) the ground floor consists of beam and block construction with 250mm Kingspan Kooltherm K3 insulation, and a concrete slab over

SELECTED PROJECT DETAILS

Client: Southern Housing Group
Architect: PCKO
Structural engineer: Conisbee
Passive house consultant: Warm
Project management: Calford Seaden
Contractor: Stoneham Construction
Mechanical contractor: Clarke's Mechanical
Electrical contractor: Trevor Jones Contracting
Aerated concrete blocks: H+H UK
External wall insulation: Wetherby Building Systems
Thermal breaks: Green Building Store/ Marmox
Windows: Munster Joinery
Roof lights: DVS & Fakro
External doors: Ecohaus Internorm
Airtightness membranes: PYC Systems
Window shades: Renson
Gas boilers: Valiant
MVHR: Zehnder ▶

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(left and below) the houses feature cathedral roofs, with triple glazed Fakro roof windows over the stair-wells, bringing in extra natural light to help save on electricity and provide rapid purge ventilation in hot weather; (top) sliding shutters were installed on the windows to provide shading and reduce the risk of overheating in summer; (above) airtightness detailing around MVHR ductwork and (below) Kooltherm insulation at cathedral sits on Intello membrane

PROJECT OVERVIEW

Building type: 16 semi-detached houses in eight pairs and one block of 12 flats. Specific performance data is for numbers 12 & 13.

Location: Cameron Close, Freshwater, Isle of Wight

Completion date: August 2015

Budget: Total scheme costs circa £4.9m

Passive house certification: Part certified with remainder pending

Space heating demand (PHPP): 14.4 kWh/m^2/yr

Heat load (PHPP): 9 W/m^2

Primary energy demand (PHPP): 98 kWh/m^2/yr

Environmental assessment method: Code for Sustainable Homes level 3

Airtightness (at 50 Pascals): 0.48 ACH

Energy performance certificate (EPC): B 84-88

Thermal bridging: Details developed to minimise thermal bridging, concentrating on critical junctions and window installations. Thin joint blockwork with external insulation used in order to provide a continuous wrap of insulation. Marmox Thermoblock used to minimise thermal bridging at party wall, internal wall and the perimeter. Compacfoam used to optimise door thresholds and to provide a thermal break at shutter bracket mounting points. Therm modelling used extensively to evaluate design options.

Ground floor: Beam and block floor construction with 250mm Kingspan Kooltherm K3 insulation, and a concrete slab over. U-value: 0.077 W/m^{2}K

Walls: Wetherby external insulation system Rendered 230mm Kingspan Kooltherm K5 insulation on 200mm Celcon Thin-Joint block, with a parge coat internally and plasterboard finish over a services cavity. U-value: 0.076 W/m^{2}K. Where external shutters are fitted the insulation drops to 150mm, with a resultant U-value of 0.108 W/m^{2}K.

Roof: The main roof construction consists of fibre cement slates on timber rafters, with 600mm Rockwool insulation at ceiling level, a taped plywood airtightness barrier and services voids under, with a plasterboard finish. U-value: 0.066 W/m^{2}K.

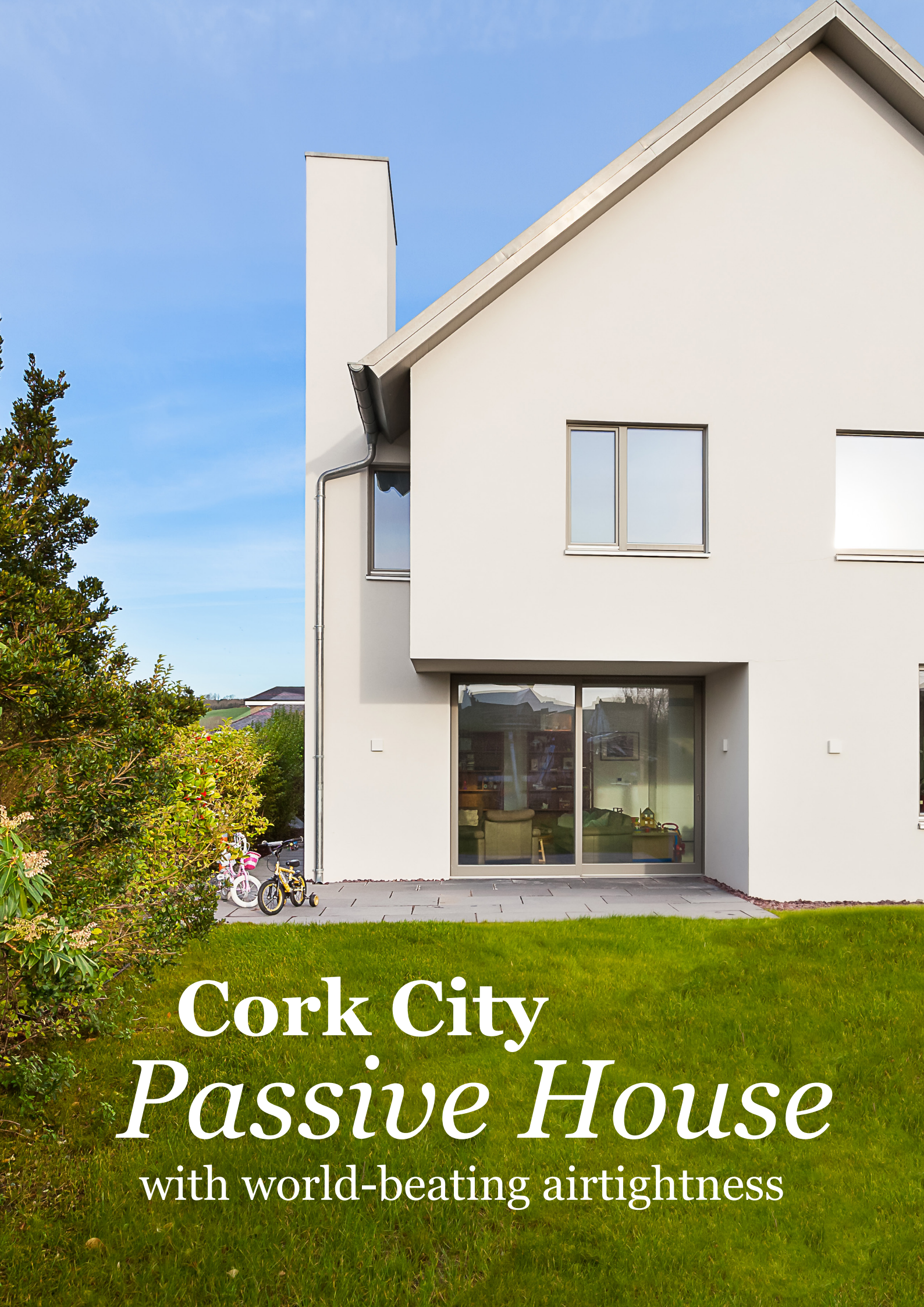
Cathedral roofs use the same roof finish, but with 150mm Kingspan Kooltherm K7 between the rafters, 50mm Kingspan Kooltherm K18 below the rafters, and a plasterboard finish. U-value 0.144 W/m^{2}K.

Flat roofs consist of a single ply membrane over Kingspan Thermataper TT47 insulation tapered to achieve a 1:60 fall, over an 18mm plywood deck on 219mm Easijoists forming a services void, with a plasterboard finish. U-value of 0.107 W/m^{2}K.

Windows: Munster Joinery Passiv Aluclad windows and Internorm KF410 (with P2 Foam) doors, all triple glazed. Fakro FTT U6 triple glazed roof lights. Overall glazing U-value of 0.84 W/m^{2}K.

Heating system: Vaillant EcoTec Plus 824 condensing gas combi boiler with wet radiator system.

Ventilation: Zehnder Comfoair 200 MVHR system, Passive House Institute certified as 92% efficient. Effective heat recovery efficiency as installed 86%.



Cork City
Passive House
with world-beating airtightness

This stylish new passive house in Cork City managed to achieve one of the best airtightness results Passive House Plus has ever witnessed using an innovative new Irish-manufactured airtight timber board

Words: John Cradden
Photos: Maann Photography

If you are an architect and you let slip to your professional peers that you are thinking of building your own home, be prepared to get your ears bent. Don't do it, they warn. You'll never be happy. You'll be your own nightmare client. You'll keep designing and re-designing for an eternity. No-one will want to work with you.

As a breed, architects can tend towards perfectionism and Boris de Swart, by his own admission, is no exception. But while he was mindful of the warnings, all the encouragement he needed came from no less than his wife. Boris, co-director with Greg Tisdell of Studio D architects in Dublin but who bases himself and his family in Cork city, had designed and managed several low-energy homes that only went part of the way to the passive house standard.

"Those houses had been a learning curve for all involved, and when I was presented the opportunity to build from scratch for myself, what seemed like the ultimate challenge was there," he says. If any further evidence was needed of his willingness to get stuck in, he also became the main contractor on the project.

"From the beginning of the project I had been putting out feelers for a contractor who would build to the standard that I would feel acceptable — keeping in mind the very tight budget — which proved fruitless," he says.

From the outset he had intended to get his hands dirty on site, both for cost reasons and to keep an eye on things. "By the time planning permission was granted, I figured that seeing as I was going to be on site every day to make sure everything was done the way I wanted it, I might as well act as the main contractor myself."

While choosing to be the contractor as well as the architect for a full, first-time passive house construction — never mind a conventional build – might seem like a classic case of misguided bravado, Boris says the project was really set in motion after contacting Shoalwater Timberframe in Wexford, and then a window supplier.

Donal Mullins of Shoalwater, who has built a strong reputation for passive house construction, has form in working with architects on their own new-builds, such as the Carlow home of Helena Fitzgerald that served as the cover story in issue 5 of Passive House Plus, so ▶

“When I go on to a Shoalwater site, I know it’s going to be spotless – you could eat your dinner off the floor.”

he clearly wasn’t phased about working with Boris.

As is his working philosophy, he took on the whole frame construction element of the project, leaving Boris with the more manageable tasks of building the insulated foundation slab and the services and finishes.

“There’s a huge amount of that work taken away from the hands of the contractor who sometimes wouldn’t have that experience to deal with it properly,” said Mullins. Having said that, he found Boris was very hands-on, and displayed a handy knowledge of the construction side, “which is sometimes not always the easiest thing to get across to an architect”.

The biggest difficulty for Mullins and other suppliers was the restricted access to the site on the west side of Cork City, which can be entered only via a narrow lane. Help also came from a colleague of Boris’s, Greg Tisdall, with passive house construction experience who generously offered his time and invaluable advice.

Work proceeded on the foundation with the help of friends, which included levelling the ground surface, fitting drainage pipework, service and air ducts, high-density 300mm Aerobord insulation, radon barrier and damp proof membrane, steel reinforcements and concrete, and was completed in just two weeks.

“The timber frame and windows went up in several weeks, and presented me with a skeleton house to organise to finish off.” Boris was also insistent on building with natural, healthy materials.

“Many building materials used in conventional building are quite toxic in nature and can possibly cause health issues if not used or installed correctly,” says Boris. “As I plan to be spending a large amount of time inside our house with my family, it was important to me to try and build the house as healthy as possible with as much natural materials as I could manage.”

Examples of natural materials used include the timber frame construction, timber rather than PVC windows and cellulose insulation, while the building’s embodied energy was reduced with the use of 50 per cent GGBS cement (a low carbon alternative to traditional Portland cement). Boris’s house is also one of the first houses in Ireland to use a new airtight OSB board from SmartPly called VapAirTight on both the walls and the roof. It’s manufactured in Waterford and marketed as a sustainable, robust and cost-effective alternative to specialist membranes.

“The product is obviously called VapAirTight for a reason — it’s vapour tight and airtight,” says David Murray of SmartPly. “To guarantee that very good level of airtightness we basically engineered the OSB core to be airtight.” This, he says, is in contrast to other guaranteed-airtight OSB products that use a coating or membrane. ▶

(clockwise from top left) the Kingspan Aerobord insulated foundation practically eliminates the critical wall-to-floor cold bridge; (next 3 images) the house is one of the first in Ireland to feature VapAirTight, the new airtight OSB from Smartply, which helped the project achieve world-beating airtightness — the green UV polymer coating provides the vapour tightness; the factory-built timber frame and windows were in place in just a few weeks; the external walls also feature Gutex Thermowall insulation

Traditional OSB, he says, can't guarantee airtightness, even though it is used as an airtight layer on many timber frame projects. But the nature of its manufacturing process means that its airtightness will vary — it simply isn't designed to be airtight. Murray claims that VapAirTight is also more robust than a membrane, and explains that its green UV polymer coating provides the vapour tightness (SmartPly also supply Medite Vent, a vapour open board).

Murray was on site, along with Shoalwater and Boris de Swart, for the final airtightness test — which produced a world class result of 0.09 air changes per hour at 50 Pascals, one of the best airtightness results Passive House Plus has ever witnessed. According to airtightness tester Gavin Ó Sé of Greenbuild, the result owes a lot to Shoalwater's precision: "When I go on to a Shoalwater site, I know it's going to be spotless – you could eat your dinner off the floor," says Ó Sé. "Every perimeter is accessible. There's no rubbish – nothing cluttering the way – so that with every junction, every possible leakage location is plainly visible without having to move things. That makes my job easier as a tester, but it also makes their job easier as installers because they can see everything as they work to make sure it's nice and clean."

Boris also had a strong input into the heating, hot water and ventilation set-up, which is provided by a Nilan Compact P system. A heat pump drives the underfloor heating and hot water buffer tank and is linked to a combined ventilation/domestic hot water system.

In an ideal world, underfloor heating would not be needed in a passive house, but Boris chose to install it after hearing feedback from a colleague regarding other passive house projects where the clients complained of their homes being too cold in winter, even with their wood stoves on.

Maurice Falvey of Nilan Ireland says his job was made easier by Boris's meticulous planning. "He had accounted for the ventilation system in his design, so on an upfront basis he was able to bed-in the ventilation system, which was great as there was more planning put into it."

He adds that one advantage of the Compact P system from an installation perspective is that because some of the ground floor supply air is actually in the floor, this effectively reduces the amount of pipework that you need to put through the rest of the house. "All of the supply air pipes for the ground floor are encased in the insulation in the ground floor, helping to reduce the number of pipes in the intermediate floor. This reduces the congestion of pipework significantly," said Falvey. "This also improves comfort, by delivering supply air at floor level rather than ceiling level, creating a more balanced temperature and air distribution."

Boris says he is planning solar PV panels as soon as the government decides once again to re-introduce feed-in tariffs for microgeneration.

The final result — particularly the airtightness — is surely a strong vindication of Boris's bravery, but also his careful planning as the house is "pretty much exactly" as he had envisaged it from day one, he said. From the outside, the 238 square metre, two-storey detached building looks highly impressive and even imposing, but also very neat and uncluttered. Boris and his family moved in last August. "Our impressions so far are fantastic. Light and space abound. The kids are in love with the house – they still call it 'the new house'. We are all delighted with it, "he says.

"We love the generous spaces, the daylight inside, the amazing kitchen, the crafted stairwell which links the floors, the landing which is another play area for the kids, the atmospheric lighting amongst others."

In terms of the cost vs a conventional build, Boris was prepared to build below passive standards at the outset in order to keep to his relatively low budget. "But the more I researched, it appeared it could be done for much the same cost as a reasonably well-built standard house."

One slight compromise in terms of looking for full passive house compliance was the Kneer/Woodmarq timber windows. "To make the jump from really good timber frame triple-glazed windows to passive timber frame certified windows (or equivalent) there is quite a price increase. We wanted to avoid PVC windows at all costs."

However, while the preliminary indications are that it would pass, they chose not to obtain passive house certification. "The budget we had to work with was already somewhat short, and from my research to obtain certification costs in the region of €4000 by the time you have construction details verified and the certification process done."

Donal Mullins confirms that this is also the case with a lot of his clients, as certification is often among the initial costs that ►

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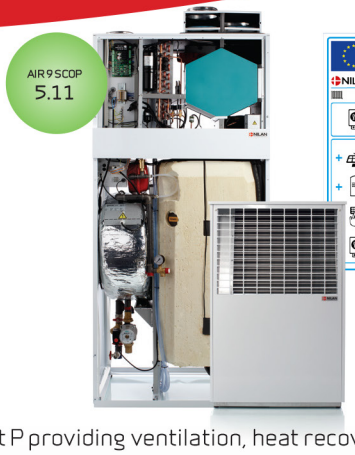

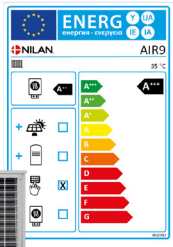

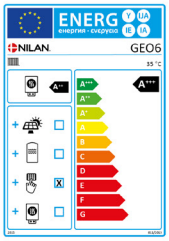

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are sacrificed in order to stick to a budget. However, Boris says he has every intention of obtaining certification at a later date and if the preliminary measurements are correct, it should be a walk in the park.

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SELECTED PROJECT DETAILS

Client, architect & project management: Boris de Swart
Timber frame: Shoalwater Timberframe
Insulated foundations: Kingspan Aerobord
Structural engineer: Hilliard Tanner
Airtightness tester: Greenbuild
GGBS: Ecocem, via Keohane Readymix
Airtightness board: SmartPly
Airtight tapes & Gutex insulation: Ecological Building Systems
Heating & ventilation: Nilan Ireland
Roof windows: Velux
External windows & doors: Woodmarq
Electrical: MC Electrical
Plumbing: John Paul Corkery Heating & Plumbing
Timber floors: Junckers
Beam central vacuum system: Solastech

PROJECT OVERVIEW

Building type: 238 square metre detached two-storey timber frame house

Location:
Model Farm Road, Cork, Ireland.

Completion date: August, 2015

Budget: N/A

Passive house certification: not certified

Space heating demand (PHPP): 15.3 kWh/m²/yr

Heat load (PHPP): 9.8 W/m²

Primary energy demand (PHPP): 115 kWh/m²/yr

Airtightness: 0.09 ACH at 50 Pa

BER: Pending from BER assessor

Thermal bridging: Virtually no cold bridge at foundation/walls, walls/roof and walls/windows junctions. Aerobord insulated foundation connecting insulation layer to walls. Window/door reveals insulated. Y-values pending.

Ground floor: 100mm concrete insulated raft floor insulated with 300mm Kingspan Aeroboard. U-value: 0.11 W/m²K

Walls: Factory-built timber frame with 10mm silicone based render on 60mm Gutex Thermowall, fixed to 225 x 44 cellulose filled stud, 12mm taped and sealed SmartPly VapAirTight, 50mm service cavity, 12.5mm plasterboard internally. U-value: 0.14 W/m²K

Roof: Roadstone concrete roof tiles externally on 50x35 battens/counter battens, followed underneath by breathable roofing underlay on 12mm Medite, 380mm timber posi-joists fully filled with cellulose insulation, 12mm taped & sealed SmartPly VapAirTight, 50mm service cavity, 12.5mm plasterboard ceiling. U-value: 0.10 W/m²K

Windows: Kneer/Woodmarq triple-glazed solid timber spruce frame windows, with argon gas filling and overall U-value of 0.85 W/m²K

Heating & ventilation system: Nilan Compact P heat recovery ventilation and heating system supplying underfloor heating and 430 litre domestic hot water tank

Green materials: Timber frame, cellulose insulation, 50% GGBS cement.

Farmhouse-inspired HOME

goes passive on a shoestring...

Photos: Imageworks Photography

This remarkably low cost build in rural Co Meath adds to the evidence that it's possible to meet the passive house standard on a tight budget – with a number of additional green technologies thrown in for good measure

Words: Lenny Antonelli

This rural house near Navan, Co Meath meets the passive house standard while embracing an old Irish design vernacular, making it an elegant low-energy addition to its rural setting. The house is the brainchild of its owner, Michael Mills, who runs Cladit Design, which provides rain screen cladding and roofing services throughout the UK and Ireland. Being in the industry, he was naturally eager to dig his teeth into the project.

Michael and his wife Anna were gifted a site by Michael's parents, a fairly long and narrow sliver of land outside Navan. Michael says: "During the design, which I started seven times to get it to feel right, my research led me to many different avenues. One of these I stumbled on was the passive house standard," he says. "As soon as I started reading into it I was hooked and subsequently sold the idea to my other half."

Intriguingly, one of the couple's guiding principles during the design was to make the house smaller. He continues: "One of the current symptoms I see a lot is in our parents' generation and probably true the world over is that of a large family home being lived in one or two rooms, due to the costliness to heat and maintain the whole property," he says.

"We knew the reality that within 15 years our child would no longer be living with us. This tied in well with reducing the overall size. A mantra we followed was that every square metre has to be paid for, decorated, then heated. Our redesigns soon had us really questioning our needs for space."

At 186 square metres the house may not be tiny, but it certainly shuns the Celtic Tiger McMansion trend that proliferated during the building boom, and that is still often the norm for one-off rural houses. Its simple, elegant design is also a ▶

“I wanted to prove this newfangled standard can be achieved with normal materials and normal trades.”

pleasant antidote to both ghastly pre-boom bungalows and some of the crasser designs that have sprung up around the country in recent years.

“The traditional Irish farm building held an interesting style in its height proportions, a very basic structure, usually two-tiered for livestock beneath with storage above,” he says. “We tied two of these forms together to form two ‘blocks’ which were interlinked.”

Meanwhile the construction itself emphasises traditional methods and materials, with a strip foundation and ultra-wide cavity wall construction that’s insulated with polystyrene bead, with low thermal conductivity Quinn Lite blocks at the wall-floor junction. “Being close to the trade I knew I could easily achieve what was required by working with trades who personally knew me. Our tight budget meant I also had to make the design relatively easy to build,” says Mills. “Less complicated meant less headaches…I also wanted to prove this newfangled standard can be achieved with normal materials and utilising normal trades.”

He admits that taking on the task of designing and building his own passive house from scratch was daunting. “At the very start of the project in design stage the whole PHPP seemed really overwhelming and confusing, trying to tie in all the systems seemed a daunting task,” he says. So he brought in passive house consultant Archie O’Donnell to guide him through the process.

O’Donnell says: “The goal was that he should be able to engineer a passive building for the same budget as conventional. It was a very interesting approach and it went through a lot of iterations. He was very driven to learn about different strategies or approaches.”

According to O’Donnell, this hands-on approach is something of a trend. “We’ve noticed this with a lot of people doing passive. They want to learn the process themselves and then deliver it themselves.”

Naturally enough, airtightness was one of the biggest challenges. “I also strived hard to maintain the airtight line right from the start — one of the areas we fell down on, and only came to light under the air test, was the joist hangars,” says Mills.

He explains: “In hindsight we would have plastered a sand and cement screed on the block before any hangers were built in. Having to go back and tape these up was quite stressful, but if that was it then I class it as a success!

Besides the wide cavity walls, the thermal envelope is finished with a corrugated anthracite roof (much cheaper than slates) that’s insulated with Xtratherm, a strip foundation under the ground floor — again ▶

insulated with Xtratherm — and triple-glazed windows.

The main source of heat is a Glen Dimplex air source heat pump, delivering to underfloor heating on the ground floor and two towel rads upstairs. There's also a Glen Dimplex heat recovery ventilation system, all of which was supplied and installed by Midland Renewables, and a 7.5 sqm solar photovoltaic array.

The final build costs came in around €800 per square metre — exceptionally good value for any new build, let alone a passive house, especially considering the addition of both thermal and electrical renewable energy technologies and a rainwater harvesting system. How did Mills manage to keep the budget in such tight check? "Lots of pre design before planning and everything [being] detailed prior to digging foundations really helped with costs I think," he says. "Being able to accurately quantify materials plus being able to get sub-contractors to accurately price was a great help. The day we dug foundations I had 45 detailed drawings available on site. Having a basic idea of material costs also helped during design.

"Being in the trade and qualified I suppose took a lot of costs for us out of the equation, such as design, project management and general dogsbody," he adds.

Mills moved into the house in August 2015, so was only just experiencing his first winter when interviewed by Passive House Plus. "The house reacts so well to any little heat input I am not wary of any future bills. One of the other insights is how well the house works when it is occupied," he says. "Cooking, the dishwasher, the condenser dryer all add very noticeable heat."

"At the initial design stage when selling the passive standard ideal to my wife I made a promise that she would never feel cold again at home. To date she still comments on it and still can't quite believe how well it works." The house is currently awaiting passive house certification.

SELECTED PROJECT DETAILS

Client: Michael & Anna Mills
Design: Cladit Design
Civil & structural engineers: JOR Engineers
Passive house consultant: Archie O'Donnell
Main contractor: Michael Mills
Wall insulation: Warmfill
Roof & floor insulation: Xtratherm
Airtightness products: Ecological Building Systems
Windows & doors: True Windows
Roof windows: Keylite
Rainwater harvesting: CMD Environmental
Mechanical contractor: Midland Renewables
Airtightness tester & consultant: SC Airtightness & Ventilation
Rendering and plastering: Sean Doherty
Floor screed: Sean Boyle
Roof sheets: Pearse Roofing & Cladding ▶

(below, clockwise from top left) pro clima Intello membranes – installed before stud walls were built for continuity – provide airtightness and vapour control on the inside of the roof; fresh air is delivered by a Glen Dimplex MVHR system, seen here on the right, alongside a 250 litre tank that stores heat from the Glen Dimplex air source heat pump; Quinn Lite blocks installed around windows to reduce thermal bridging

"The final build costs came in around €800 per square metre — exceptionally good value for any new build, let alone a passive house with added renewables & rainwater harvesting."

PROJECT OVERVIEW

Building type: Detached, storey-and-a- half wide cavity wall house, 186 square metres

Location: Ardbraccan, Navan, Co Meath

Completion date: August 2015

Budget: €150k (not counting €8k council fees)

Passive house certification: Mid certification process

Space heating demand (PHPP): 15kWh/m^2/yr

Heat load (PHPP): 10 W/m^2

Primary energy demand (PHPP): 119 kWh/m^2/yr

Airtightness: 0.6 ACH

BER: A2 37.14 kWh/m^2/yr (CO_2 Emissions Indicator 8.18)

Energy performance coefficient (EPC): EPC= 0.249

Carbon performance coefficient (CPC): CPC = 0.259

Thermal bridging: Quinn Lite B3 thermal blocks to slab edge, wide cavity with SS wall ties. Bespoke reveal/opening thermal bridge detail. Bespoke steel corner to corner windows, Xtratherm warm roof build up. Pre design for entire building and its components to work within the airtight/warm line.

Ground floor: Wide strip foundation, 100mm concrete, 200mm Xtratherm XT/UF Quinn Lite double block course to perimeter. 88mm traditional screed. U-value: 0.09W/m^{2}K

Walls: 22mm external render in two coat build up, on 100mm standard block, on 250mm cavity fully filled with Warmfill Super Silver bead, stainless steel wall ties at four per square metre, 100mm standard block, internal plaster and skim. U-value: 0.12 W/m^{2}K

Roof: BF PVC 0.7mm Anthracite corrugated roof on 75x100mm for cold roof portion into a warm roof, pitched roof, breathable membrane, warm with Xtratherm between and over rafters at 400mm c/c. airtight membrane, 150mm service cavity (Warm) U-value: 0.16 W/m^{2}K

Windows: Triple-glazed argon filled low-E aluclad windows and doors an overall U-value of 0.80 W/m^{2}K

Heating system: Glen Dimplex LA6mi air source heat pump with SPF of 386%, underfloor heating ground floor only, two towel rads upstairs. 250 litre tank, 4 PV panels

Ventilation: Glen Dimplex ZL300VF MVHR system Passive House Institute certified to have heat recovery rate of 75% / EN certified efficiency of 86%

Electricity: 7.54m^2 solar photovoltaic array with average annual output of 2.37kW

Green materials: All building materials locally sourced within a 20 mile radius bar window units and mechanicals. Local contractors used.

Bristol deep retrofit *proves worth with monitoring*

"A misconception has grown in the last few years that low energy houses are somehow more prone to overheating than 'traditional' houses"

Photos: Ben Wright Photography

This unique energy retrofit in Bristol walked a fine line between ambition and pragmatism to deliver a healthy, comfortable and ultra-low energy home

Words: John Hearne

Deep retrofits can sometimes go so far that they're effectively new builds in everything but name. Others tinker at the edges of the thermal envelope without really tackling the building's fundamental problems. This Bristol retrofit and extension is different. Here, the design and build team expertly walked the line between the possible and the practical, to deliver high comfort, low energy living.

Ian Mawditt — owner and designer of the project — is an independent building performance researcher. As such, he could hardly be better placed to embrace the challenges of retrofitting this 1962 detached two-and-a-half storey home, on the fringes of Blaise Castle Estate in Bristol.

Before moving to Bristol from Oxford, Mawditt and his wife Corinne had been thinking in terms of retrofit, if the right property came along. But when they pulled up outside the nondescript 1960s house they had arranged to see with the estate agent, they took one look and decided that it wasn't for them.

"Both myself and my wife have a preference for older buildings, for things that have a bit of character about them. And this was lacking much external character."

When they got inside however, they discovered that the house had been built into a hill, and that the back garden fell away steeply, putting the ground floor at tree-top level.

"It's a bit strange," says Mawditt. "You all of a sudden feel as if you're in a rainforest out the back...The location was so fantastic that it made us look at the house differently. I looked around and thought, you know what? There's something you could do here."

In addition to recasting the building's thermal and comfort profile, the project also involved converting a storage space on the lower ground floor into a kitchen/diner, and adding a side extension. The project also set out to address the house's nondescript facade, and give it a more engaging aesthetic.

The key challenge on the build was apparent to Mawditt almost as soon as he pulled up to the house that first day. Like so many buildings of this era, concrete elements were everywhere, from the gutters to the steps to the balcony at the back. Great for stability, but not so good for thermal bridges. Everywhere he looked, he could see clear evidence that any attempt to upgrade the building envelope would be futile without tackling those thermal bridges.

The house featured a concrete finlock guttering system, but unlike the standard guttering systems we're familiar with today, the finlock system is actually a structural element. "These gutters act as a gutter first," says Mawditt, "but they also span all the way through to act as the wall plate, so they take the roof trusses, the rafters and the full roof load. In an ideal ▶

(clockwise from top left) Insulá thermal breaks used to prevent cold bridging at a steel column; new extension constructed from H+H Celcon high strength AAC masonry, which was insulated with 120mm of Kingspan Kooltherm; the Green Building Store Eco Contract triple-glazed timber frame windows were installed outside the existing brickwork, designed to sit flush with the new Kooltherm external insulation

world, we would take the roof off completely, get rid of the gutters and put in a completely new, thermal bridge-free roof onto the building."

When he examined the roof more closely however, Mawditt saw that despite the fact that it was more than fifty years old, it was still in good condition. But he says that while the ideal solution would have been to install a completely new roof, doing so would have blown his budget.

"I realised that I couldn't justify skipping the whole roof and […] putting in a new one just to deal with thermal bridges. There had to be a more economic way of doing this."

While Mawditt himself worked on the overall design, he brought in Ruairi Kay of Taylor Kay Architects to work up the detailed drawings that would guide the work and allow them to go to tender.

Kay had amassed significant retrofit experience working on the Retrofit for the Future programme run by the Technology Strategy Board (now Innovate UK), and had encountered houses of similar style and vintage to Mawditt's.

Kay explains that he worked on eight separate solutions to the guttering problem, ranging from taking off the roof to leaving the gutter untouched and using internal insulation to mitigate the thermal bridge. The former, as Mawditt pointed out, was impractical, wasteful and expensive. The latter wouldn't have gone far enough.

In the end, Kay explains, it was decided to cut the gutters flush with the existing walls, then bring up the external wall insulation as far as possible. "We extended the existing rafters and created a new eaves line," he says, "plus we managed to get 60mm of Kingspan insulation across the top of the gutters. That was enough to bring the thermal bridges down to an acceptable level."

Then there was the balcony. This was an extension of the ground floor slab that extended into the external space. Left as it was, it would conduct any heat energy directly into the outside. Mawditt and Kay decided to shear it off, again, flush with the existing building, and replace it with a wooden balcony. As with the gutter, this doesn't eliminate the thermal bridge but it does reduce the problem to an acceptable level.

Pragmatic solutions were also applied to some of the more endemic issues on the house. "Certain concrete elements are there to anchor the house into the hill," Mawditt explains. "These created thermal bridges that were simply too difficult to deal with. On the south side, where the original concrete steps are cast against the house, all we could do was install some internal insulation on the other side to minimise, but not eliminate, the thermal bridges."

Ruairi Kay says that the challenges posed by the project are typical of retrofits on houses of this era. Dealing with them, he says, requires a subtle blend of expertise and compromise. "It's definitely a major problem. All these fifties and sixties properties tend to have a lot of concrete detailing, but it's a balance between finding a practical solution that's also thermally effective without pulling the whole thing down."

Once the thermal bridges were dealt with, upgrading the thermal envelope was the next priority. Mawditt relied upon external wall insulation, together with passive standard, timber framed, triple-glazed windows.

There were also challenges to getting the insulation strategy right. Mawditt explains that he removed and lowered the original slab in the new dining area on the lower ground floor to increase headroom and to provide the opportunity to insulate the floor. That however was an expense he couldn't justify in the existing utility room on the same level.

"This meant that our options for insulating the existing floor slab were limited because we didn't want to further reduce the low floor-to-ceiling height [at 2.1m] much further. Even 100mm of insulation was out of the question."

The compromise here was a 20mm layer of Spacetherm, which uses Aerogel insulation. This is an ultra-high performance — and consequently expensive — insulant that's bonded to chipboard, which was laid directly over the original floor. You don't get the same thermal standard as the rest of the house, but that 20mm has cut heat loss through the utility floor by almost 60%, reducing the U-value from 0.59 to 0.25.

With an eye to what might be learned from the experience, Mawditt deployed a range of sensors and data loggers about the house, both before and after the build. He's now been through two heating seasons since the work was completed, and the results make for fascinating reading.

Take overheating for example. Mawditt points out that a misconception has grown in the last few years that low energy houses are somehow more prone to overheating than 'traditional' houses. He notes too that as the pressure for space grows, it's become increasingly common to put bedrooms into roof areas that used to be ventilated loft space.

"When you start building into the roof, if you don't deal with the overheating potential, ▶

and try to dilute some of the solar radiation, you're going to have an overheating issue, particularly in that room, and that will transfer down to the lower rooms."

Before the retrofit, the summer temperature in the bedrooms reached an unbearable 35C. Since the project was completed however, the data loggers have recorded maximum summer temperatures of 26C in the bedrooms.

In part this is thanks to the external placement of the insulation. During the winter, it keeps the heat from escaping from the house, but during the summer, it keeps it from getting in. In addition, the render layer on the outside is deliberately light in colour, so that it radiates away solar energy rather than absorbing it. Additionally, the new windows have much better solar control.

Based on monitoring data, overall energy use in the house has been reduced by 73%, while the energy required for heating alone is down 90%. In the year before the works were completed, the total gas bill came to £1200. In the first year after completion, gas costs for both space and water heating came to £225.

Mawditt had anticipated that total space heating demand would just about meet the Enerphit standard of 25 kWh/m^2/yr. In the first year, however, it didn't get above 14 kWh/m^2/yr, and following further tweaks to the system, it's now down to 12 kWh/m^2/yr.

He notes too that he inherited a relatively new boiler from the previous owner that is grossly oversized for the house's heating needs, but he plans to replace it in future.

One other interesting finding is that the total energy costs for the MVHR system amount to £37 a year (plus £50 a year for filters), which again shatters the misconception that running two fans constantly requires a lot of energy. "Thirty seven pounds," says Mawditt, "is a small price to pay for comfort and good indoor air quality."

His monitors also tracked relative humidity (RH) and CO_2 concentrations. RH should lie between 40% and 60%. Much lower than 40% can lead to a feeling of dryness and discomfort; much higher than 60% can lead to condensation and mould growth.

Average relative humidity in the main bedroom came in at 57% in the first year post-renovation, within the comfort band, but slightly high due to the recent re-plastering of the room and the associated moisture content. The average relative humidity on this floor has since fallen to 48%.

Mean CO_2 levels should ideally be within 1500ppm. The ventilation system air flows have been commissioned to ensure this threshold is not exceeded, which has been confirmed by the logged data.

"The logged data shows that it's a very stable environment from a temperature and humidity point of view." says Mawditt. "The MVHR system is fine-tuned to keep CO_2 levels under control. The comfort is quite remarkable compared to its pre retrofit state, between winter under-heating and summer overheating. And comfort is something that should be emphasised as much as energy."

For more information about this project visit: fourwalls-uk.com/blog. Ian Mawditt, owner and designer of the project, is an independent building performance researcher. Originally an M&E engineer, he returned to university some years ago to complete a masters in sustainable architecture. Since establishing his own business, his key professional activities include field-based building research in new and existing buildings, evaluating energy performance and targets, and occupant comfort. Much of this research has been used to support various revisions to the building regulations and related approved documents for Part L and Part F. He is also an expert advisor to the Technology Strategy Board (now Innovate UK) on both their Building Performance Evaluation and Retrofit for the Future Programmes.

Want to know more?

Click here to view additional information on these projects, including an online gallery featuring illustrations, photographs, and project overview panels.

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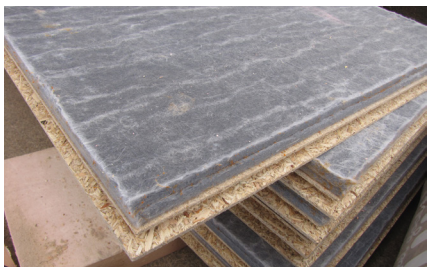
(clockwise from top) pro clima airtightness tapes and grommets were used around service penetrations; because Ian Mawditt was keen to avoiding limiting headspace, ultra-thin and highly insulating material Aerogel was used to insulate the ground floor, with 20mm delivering a U-value of 0.25; new green roof to the extension, with three Velux triple-glazed roof windows; Mawditt commissioning the MVHR system; which includes stainless steel spiral ductwork

SELECTED PROJECT DETAILS

Clients: Ian Mawditt & Corinne Welch
Design: Ian Mawditt & Taylor Kay Architects
Energy rating assessment: Ian Mawditt
M&E engineer: Ian Mawditt
Main contractor: Greenheart Sustainable Construction
Heating engineer: Bent Copper Plumbing
Electrical engineer: Kilo Electrical
Extension roof and sedum layer: Poole Single Ply
External wall insulation: Kingspan
Internal Wall Insulation: Natural Building Technologies
Cavity wall insulation: Ecobead
Blown cellulose insulation: Warmcel
Windows, doors & heat recovery ventilation: Green Building Store
Roof windows: Velux
Airtightness products: Ecological Building Systems
Magnesium silicate boards: Resistant Building Products
Rainwater harvesting: Rainwater Harvesting Ltd
Thermal breaks: Insulá
Existing floor insulation: Spacetherm, via the Passivhaus Store
AAC blocks: H+H ▶



Photos: Ben Wright Photography

PROJECT OVERVIEW

Building type: 1960s two-and-a-half storey detached cavity wall house with new extension. Floor area of 188 sq m.

Location: Bristol, England

Project budget: £155,000

Space heating demand (SAP 2009):
Before: 170 kWh/m²/yr
After: 17 kWh/m²/yr

Primary energy demand (SAP 2009):
Before: 361 kWh/m²/yr
After: 58 kWh/m²/yr

Energy performance certificate (EPC):
Before: E 46
After: B 89

Measured space heating consumption:
Before: 140 kWh/m²/yr (Oct 2010 to Sep 2011)
After: 12 kWh/m²/yr (Oct 2014 to Sep 2015)

Gas consumption (heating and hot water):
Before: 158 kWh/m²/yr (Oct 2010 to Sep 2011)
After: 26 kWh/m²/yr (Oct 2014 to Sep 2015)

Electricity
Before: 27 kWh/m²/yr (Oct 2010 to Sep 2011)
After: 15 kWh/m²/yr (Oct 2014 to Sep 2015)

Total measured energy consumption (gas and electricity):
Before: 185 kWh/m²/yr (Oct 2010 to Sep 2011)
After: 41 kWh/m²/yr (Oct 2014 to Sep 2015)

Gas bills

Before: £1230 (Oct 2010 to Sep 2011)
After: £225 (Oct 2014 to Sep 2015)

Airtightness (at 50 Pascals)

Before: 18.6 m³/hr/m² at 50 Pa
After: 1.4 m³/hr/m² at 50 Pa

Walls
Before: Existing masonry cavity wall (60mm cavity unfilled). U-value: 1.4 W/m²K
After: Existing masonry cavity wall infilled with Ecobead+ (nominal 60mm depth). Cavities edge-sealed at top. External wall insulation applied using 2 x 60mm layers of Kingspan Kooltherm K5 over a sand/cement slurry coat (air barrier). Finished in render or ventilated timber cladding. U-value: 0.12 W/m²K

Internal wall insulation applied in some areas where special restrictions limited the ability to continue external insulation (e.g. south wall section on lower ground floor). Internal wall insulation used instead, limited to 100mm + cavity wall insulated with Ecobead. U-value: 0.17 W/²mK

Extension walls: H+H Celcon high strength AAC masonry – 190mm 7.3N/sqmm blocks. Insulation/air barrier/finishes as per existing walls. U-value: 0.14 W/m²K

Timber infill section walls: Timber ladder frame infilled with 145mm Kooltherm K5 + 120mm external wall insulation (265mm insulation total). U-value: 0.10 W/m²K

Existing roof
Before: original roof, cold loft, timber with concrete tiles. 50mm nominal insulation with vermiculite, poorly laid, causing condensation in winter. U-value (nominal): 0.75 W/m²K
After: Existing roof insulated using Warmcel blown in to a depth of 300mm, with a further 300mm on top/around MVHR ducting. Area-weighted U-value: 0.1 W/m²K

New roof to extension: Flat, warm roof construction made up from 20mm marine ply taped with Tescon No.1 tape, with Alutrix 600 vapour control layer and 150mm Kingspan Thermaroof TR26 laid on top. Cefil single ply membrane laid over insulation, topped with sedum layer dressing. U-value: 0.14 W/m²K

Windows & doors
Before: Mixture of single-glazed, timber windows and doors, and double-glazed uPVC windows. Overall approximate U-value range: 2.4 to 3.2 W/m²K
After: New triple-glazed timber frame windows with double low-e coating (4/16/4/16/4) and argon fill. All as per Green Building Store Eco Contract range. Overall U-value of 0.90 W/m²K

Roof windows: Three Velux triple-glazed units on flat roof. Overall U-value: 0.85 W/m²K

Heating system
Before: New A-rated (SEDBUK 89.2% eff) gas boiler installed by previous owner, but connected to the original single pipe, conventional open vent system, utilising skirting radiators throughout entire building.
After: Boiler retained, but connected to a new sealed twin pipe system. Radiators are small panel type, between 300 and 500 watts depending upon room size. Minor efficiency issue – boiler is now grossly over-sized (size for a big inefficient building), meaning that it runs less efficiently. It was felt wasteful to discard such a new boiler, but it will eventually be replaced with a smaller unit.

Ventilation
Before: No ventilation system. Reliant on infiltration, chimney and opening of windows for air changes.
After: Paul Novus 300 heat recovery ventilation system. EN 308 certified efficiency of 94.4%. All ducting is Lindab SAFE galvanised steel – double sealed, airtight installation.

Green materials: Cellulose (loft) and wood fibre (IWI) insulation materials used. Sedum extensive roof layer dressing to extension roof.

Low energy Waterford

retrofit with a classic look & feel

Builder Conor Walsh undertook an ambitious partial rebuild, partial retrofit to this 1960s bungalow, delivering deep energy savings and turning it into a modern family home

Words: John Hearne

A major retrofit and extension of a bungalow in Co. Waterford approaches the Enerphit standard by taking a fabric-first approach and combining a range of building methods, including cavity wall, insulated concrete formwork (ICF) and external wall insulation (EWI).

The house is the brainchild of Conor Walsh, who runs Encon, a Waterford-based construction company specialising in green building with the aid of his construction project manager Robert Keohan. Walsh had been looking for a site to build a home for himself and his family, but rather than opt for a new build, he decided instead to renovate and substantially extend a sixties-era cavity wall bungalow on a site at Leoville in Waterford City.

"While it was habitable," he says, "the space wouldn't have worked for us...We never planned to live there; we bought purely for the site and the location."

Conor's young son is a wheelchair user, and for that reason, it was important that the house remain a bungalow. But because the existing house had such a poor energy profile and was not designed with wheelchair use in mind, much of it was unusable.

"The orientation of the existing house was right, so we kept the bedrooms on the north and east elevations, while most of the living spaces in the house were south and southwest facing. For that reason, we used 90% of the original foundations and retained about 20% of the original walls."

Passive principals always favour a compact footprint in order to minimise heat loss form factor. This is the ratio of heat loss surface area to the useable floor area. Typically, form factors lie between two and four, with 2.5 considered optimum. At Leoville, Conor Walsh achieved a ratio of 2.72.

This was no small achievement given the size of the house (340 square metres) and the fact that everything was on one floor. Walsh explains that while his architect advised an ▶

"We were aiming for close to passive standard and put a lot of money into the building fabric, which in turn requires a minimal heat system"

L-shaped footprint, he felt that this would drive the form factor too high. Moreover, he liked the solid, square aesthetic of period homes, and wanted to achieve something similar. The problem was that building a large square house would have left the central section without natural light. The solution was an atrium at the centre, with a large glazed section built into the roof.

"We were very conscious of the fact that because it was a bungalow, there would be quite a large floor area. That's why we concentrated on getting it square and compact, keeping it nice and tight...And that lead to the design of the atrium."

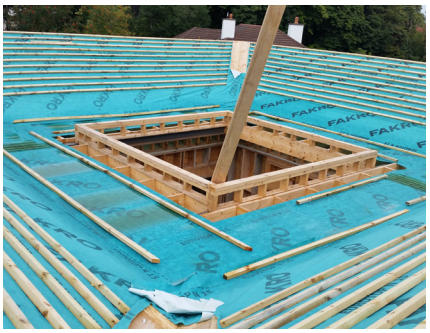
Walsh chose insulated concrete formwork (ICF) as his build method for the new part of the house. A long-time fan of ICF, he says that one of the primary reasons for choosing it was because thermal bridge free construction is inherent to the system.

"When it comes to thermal bridging, your main problem is always going to be how each layer — floor, wall and roof — connect together. ICF is an amazing product, the way the floor slab, the floor insulation and the wall insulation connect together seamlessly. We were able to achieve an excellent thermal bridge free detail there."

The other advantage of ICF is airtightness. Because of the density of the concrete mix, ICF walls are naturally airtight. Pat Martin of Amvic, who supplied the system, says that the ICF also facilitated the installation of a very large corner window without the need for buttressing. "The system allows you greater spans because you can incorporate the necessary reinforcement in the wall without interfering with the insulation," he explains.

In order to further beef up the thermal profile of the wall, Walsh also decided to add external wall insulation to both the ICF and the cavity walls of the existing house. Given the varying thicknesses of these separate build-ups, the design and build team had to take care to ensure that the finished surface remained flush between the two, and that the insulation ran in one continuous layer.

While the ICF took care of airtightness on those sections of the renovation, special measures had to be taken to ensure the junctions between new and old sections performed to standard. Walsh also explains that instead of using an airtightness membrane on the ▶



(top left) the extension was built from insulated concrete formwork, which Walsh chose because this method is inherently free of thermal bridges; (bottom left) construction of the new atrium roof; (middle) the house's new sloped timber roof, with continuity of EPS insulation above the ICF walls; (above) the external insulation system included some unusual architectural details

ceiling, he used a combination of OSB board and airtightness tapes.

"If someone is up in an attic space and they push down on the membrane, they might break through it and nobody would know. Our method future-proofs the airtightness. I know that years down the road, this building will perform airtightness-wise just as well as now."

Ultimately, the house achieved an ACH of 1.1, just outside the Enerphit standard, but still a very good result, and a vast improvement on the 7.4 ACH measured in the house before the retrofit.

To get sufficient light and to achieve the right aesthetic, Walsh upped the glazing spec in the house. All told, it features 80 square metres of glass, against a floor area of 340 square metres. When the house was modelled in the passive house software, PHPP, an overheating risk of 10% was identified. One of the big culprits here was the central atrium.

"It was going to get a little bit too much solar gain in the summer," Walsh explains. "That's why we put opening vents in the atrium so that it acts as a natural chimney and gives us a cooling effect. We also put an extract ventilation unit in the hall to try to remove some of the warmed air."

Internal blinds have also been installed to combat any overheating issues, and Walsh reports that during the summer just gone — although it wasn't particularly hot — the house never overheated. If problems do arise, the plan is to install a cooling unit in the MVHR system, then mitigate the increased power load with a solar PV array on the south-facing roof.

Walsh, together with energy consultants Integrated Energy, explored a range of heating options before eventually deciding on a traditional approach.

"We didn't really feel the need to overspend on a heating system," says Walsh. "We were aiming for close to passive standard and put a lot of money into the building fabric, which in turn requires a minimal heat system, so we just went with a standard oil boiler and rads throughout."

That solution cost €9500 to install. The runner-up system, an air-to-water heat pump with underfloor heating, would have cost €16,500. While the latter would have delivered cheaper heat, the overall heat load is so low that the difference couldn't justify the capital spend. In addition, Walsh liked the fact that the former solution gives you heat on demand, whereas the heat pump plus underfloor combination requires a little more planning in how it's used.

"As of right now [in early December] it is 5C outside and the temperature is ranging from 18 to 20C inside the house with no heating on except in the living room, which had heating on yesterday for two hours," he says.

In addition to the extensive glazing, Walsh's design included a raised plinth, and he also installed solid granite cills on the windows, to help give the house that period look and feel. These, he admits were a tricky install, since care had to be taken to ensure that there were no thermal bridging issues.

"Generally, passive houses can be quite minimal design, quite simplistic," he says, "but I feel we pushed the boundaries here a little, and achieved an energy efficient house with some beautiful design details."

Want to know more?

Click here to view additional information on these projects, including an online gallery featuring illustrations, photographs, and project overview panels.

This content is exclusively available to our digital subscribers.

SELECTED PROJECT DETAILS
Client: Conor & Jade Walsh
Architect (planning & certification): James Reynolds
Contractor: Encon
Energy consultants: Integrated Energy & EMS Ltd
Quantity surveyors: Patrick Breen
Mechanical contractor: Walsh & Sheehan
Airtightness tester: Passive House Solutions
Insulated concrete formwork: Amvic
External wall insulation: JP Corry
Roof insulation: Isover, Knauf
Additional roof insulation: Xtratherm
Airtightness products: Gerband
Roof lights: Bunmahon Joinery
Oil boiler: PJ Mullane Plumbing & Heating Supplies
MVHR: Cyclovac ▶

PROJECT OVERVIEW

Building type: Detached house from 1960 refurbished with demolition of 70% of existing property and rebuild to an area of 340 square metres.

Location: Dunmore Road, Waterford City

Completion date: March 2015

Budget: €375,000

Enerphit certification: N/A

BER:

Before: D2 (299 kWh/m²/yr)

After: A3 BER (72.86 kWh/m²/yr)

Space heating demand (PHPP): 23 kWh/m²/yr

Airtightness (at 50 Pascals):

Before: 7.4 air changes per hour

After: 1.1 air changes per hour

New walls: Weber.Therm external insulation system comprising 6mm LAC float finish on 10mm EPS external insulation, followed inside by 285mm Amvic ICF system (65mm EPS, 150mm concrete, 65mm EPS). U-Value: 0.15W/m²K.

Original walls:

Before: 215mm concrete block walls with sand & cement plaster. U-value: 2.4 W/m²K

After: 150mm Platinum EPS insulation with Weber LAC and painted finish externally, 18mm sand and cement on 215mm cavity block, 62.5mm Polyiso Xtratherm thermal liner internally. U-value: 0.15 W/m²K

Roof:

Before: Sloped with fiberglass wool insulation. Roof tiles to sloped areas and torch on felt to flat roof areas externally. 100mm mineral wool insulation on the flat between roof joists and a plasterboard ceiling internally. U-value: 0.55 W/m²K

After: Roof slates to sloped areas and Protan roof membrane to flat roof areas externally. 400mm Knauf Earthwool insulation on the flat between roof joists and a 150mm Xtratherm with 100mm Metac combination on flat roofs and suspended ceiling below made airtight using OSB type and airtight tapes on plasterboard ceiling internally. U-value: 0.11 W/m²K

Ground floor:

200 mm platinum EPS with a 100 mm top screed above. U-value: 0.14 W/m²K

Windows & doors:

Before: Single-glazed, aluminium windows and doors. Overall approximate U-value: 2.1 W/m²K

New triple-glazed windows: Triple-glazed Passive House Institute certified aluclad windows and doors: Overall U-value of 1 W/m²K due to mixed design. From triple-glazed sliding sash to triple-glazed passive certified casement windows.

Glazed atrium: Triple-glazed atrium roof light with dry bead system by Bonmahon Joinery. Approximate U-value: 1.2 W/m²K

Heating system:

Before: 20-year old oil boiler & radiators throughout entire building

After: Grant Vortex high efficiency oil boiler delivering to low output radiators.

Ventilation:

Before: No ventilation system. Reliant on infiltration, chimney and opening of windows for air changes.

After: Systemair Save VSR 500 mechanical ventilation with heat recovery system, heat recovery efficiency of 84% to 88% according to Sap Appendix Q.

Delivering passive house at scale

Photo: Morley von Sternberg

Dublin is on the verge of taking a giant leap forward for construction, with two major authorities in the region set to make the passive house standard mandatory for new buildings. Can Ireland's mainstream building sector rise to this challenge, and what can it learn from experience of big passive house projects across the water in the UK?

Words: Lenny Antonelli

From March on, all new buildings in Dún Laoghaire-Rathdown will be required to meet the passive house standard — or an equivalent level of energy efficiency — under requirements set to come into force in the Dublin region's latest development plan. Meanwhile Dublin City Council has voted to include a similar 'passive house or equivalent' clause in its draft development plan.

Dún Laoghaire-Rathdown's draft development plan lists a housing allocation of 33,600 homes to be built by 2022. Once the existing planning permissions for more than 5,000 units and the 7,700 homes allocated to the area of the Cherrywood strategic development zone are excluded, given that the new development plan won't apply in either case, the total is closer to 20,000 new homes. That said, the developers at Cherrywood may see the business case for voluntarily going passive, or risk competing poorly with adjacent new property built to quality-assured high performance levels.

Overall, Ireland's Economic and Social Research Institute estimates that the Dublin region will need 60,000 new homes by 2021. If the various local authorities are successful in adopting the passive house standard (environment minister Alan Kelly can still attempt to veto the plans, though this looks increasingly unlikely) a large swathe of Dublin's new housing may be passive, and most of these dwellings will probably be built as part of large social or private housing developments.

This begs a question: how can a building industry that, before Ireland's construction boom, was largely known for leaky and energy inefficient housing adapt to a new reality in which it has to meet one of the world's most energy efficient building standards, and across thousands of homes and other buildings?

Pat Barry, an architect and executive director of the Irish Green Building Council (IGBC), believes it will be a challenge. The IGBC is one of the partners behind the EU-funded Qualibuild project, which is delivering free training in low energy building skills to construction workers. But Barry says the take-up has been disappointing so far given Dublin's move towards passive house, and the EU's demand that all new buildings be 'nearly zero energy' from 2021 on.

He also believes the way large-scaled projects are managed may be an inherent obstacle to achieving the passive house standard: contractors hire subcontractors who in turn hire their own subcontractors, making it difficult to vet labourers on site for low energy building skills.

"Contractors are just engineers sitting in offices project managing," he says. "They are several subcontractors removed from the chap installing the insulation."

If a new tradesperson is needed, a contractor will often call a recruitment agency, who will most likely know nothing about energy efficiency, and simply check that the labourer has a Safe Pass (Ireland's health and safety cert for construction workers). Barry suggests a more dynamic approach, whereby tradespeople carry a card that lists all of their qualifications, including passive house and low energy building skills.

"We're trying to get the message out to contractors first, and then the recruitment agencies," Barry says. The same challenges exist in the UK too, even though the country is witnessing a growing number of residential passive house developments, often driven by housing associations and local authorities. But Passivhaus Trust executive director Jon Bootland says there is still much to learn for large-scale developments.

"On the small-scale passive house projects we find there is typically one person who is incredibly enthusiastic, and they act as a quality assurance driver, and put in a lot of extra mentoring and support and quality checking. And that's fine on a small project of up to ten units," Bootland says.

But on larger projects it's simply impractical for one passive house champion to check everything — deeper quality control measures are needed across the site. He says there are three areas where things tend to go wrong on bigger projects.

The first is where the main structure of the building meets the foundation — continuity of the insulation here is critical. The second is the quality of the installation of the insulation itself. "On non passive house projects you'll often find the above ground insulation isn't continuous," he says. "If you've got a gap in the insulation it's almost worthless."

"The third thing is to do with the installation and commissioning of the services, particularly the ventilation system," he says. He points to the very high failures rates for ventilation systems installed in non-passive house projects, with research showing that many do not deliver enough fresh air.

He says large-scale passive house projects need a quality control system that checks these three items — and checks them at the time they're being done on site, not when the project is finished. This doesn't mean reinventing the wheel — contractors just need to build passive house into existing quality control systems.

> "You can't unsee passive house. Once you've been exposed to the details, the materials, the products...you can never unsee that."

The UK has about 400 certified passive house designers, but far less trained passive house builders. Bootland believes there's a danger that, if contractors price early passive house developments too high because they perceive it to be riskier, it might scare other developers off adopting the standard.

"That could slow down the uptake of passive house. What some clients have done is set a fixed price and made passive an absolute, and said: 'Go away and find out how to do it," he says. "We want people to realise it is more onerous building a passive house — but you've got a better quality product at the end of it."

Many of the the passive house advocates that Passive House Plus spoke to for this article argued that, to build passive housing on a large scale, the industry would ultimately need to embrace a big change: moving the bulk of construction from on-site to in-factory prefabrication, particularly for large multi-unit projects.

The word 'prefabricated' can often be misinterpreted as 'timber frame', but concrete buildings can be largely prefabricated too — think of large precast concrete panels. Over the last ▶

(Opposite) Large scale passive house projects are becoming increasingly common in the UK such as Octavia's Sulgrave Gardens mixed tenure scheme and Hastoe's Ditchingham affordable housing scheme

few years we've seen the first ever examples of 3D printed buildings, as pioneered by Chinese company Winsun, whose giant 3D printers use a mixture of construction waste, sand, concrete and fibreglass to print hollow walls that can then be insulated on site. If cars are precision engineered in sophisticated factories, shouldn't buildings be too?

"The idea of bringing off a lorry load of blocks, a lorry load of sticks of timber, and then trying to cut that and build a quality assured house on site, is really over," says Pat Barry. "From a construction worker's point of view, the idea of being out in the wind and rain, trying to put together a high quality product, doesn't make sense." Manufacturing quality assured products, he says, demands a comfortable production environment with proper lighting and climate control.

Leading London-based passive house architect Bram de Bruycker agrees. "Prefabrication allows you to have much better quality control on several points like insulation, draft proof construction and building in windows — and on top of that it solves problems of high labour costs and lack of skilled people that the industry is struggling with," he says.

He also sees prefabrication as a route to designing and constructing each project as a whole — with orientation, the building envelope, airtightness and services all integrated — rather than each of these being engineered separately on site.

In Ireland and the UK, with a long-established culture of block-building on site, prefabrication is unlikely to become the norm overnight. But builders who want to continue working on site may simply need to embrace evolution rather than revolution: for example, a single-leaf block or precast concrete wall with external insulation, and wet plaster inside for airtightness, is arguably much simpler to detail and build than the first example – a cavity wall partially filled with an insulation board, with additional insulated plasterboard internally – provided by the Department of the Environment on how to comply with Part L.

Right now, the Irish construction industry is waiting to see how the passive house requirement in Dún Laoghaire-Rathdown will be implemented.

Will it be the planning officers, who typically don't have much technical construction knowledge, who are required to enforce it? Or will it be building control departments — which are poorly resourced and currently inspect only 12 to 15% of buildings each year? Or could the work be contracted out to an external certification body?

Bottom right photo: Norman A. Müller / nam architekturfotografie | Bottom left photo: Paul Tierney

(clockwise from top left) While the likes of Lancaster Cohousing prove that traditional cavity wall construction can be used on substantial passive house projects; ground-breaking off-site build methods such as the timber structure for the eight storey certified passive Life Cycle Tower 1 office building in Austria may help to deliver substantial buildings at scale in the midst of a skills shortage

Regardless, Passive House Academy founder Tomás O'Leary is optimistic about Dublin's ability to meet the challenges of delivering passive houses on a large scale. He points out that, unlike many other countries, Ireland has plenty of passive house designers — plus a mature supply chain of passive house products.

"I think on the knowledge side of things, we're a bit like a seed bank that's waiting for a shower to come along," he says. "Ireland has a lot of certified passive house designers and a lot of certified passive house tradespeople. We've been out in the desert in terms of construction for the last seven or eight years, we're just waiting for the thing to come back.

"The skills are there and they're available to be tapped into." He points out that the relatively one dimensional climate and mild weather of the UK and Ireland, with our short cold season, means passive house is easier to deliver here too — passive houses simply don't need to hit the same U-values as in Central Europe.

"In Ireland, I think we're actually well positioned," he says. "We did build the first certified passive house in the English speaking world [O'Leary's own house]. We've been at this a while."

When Passive House Plus studied Ireland's building energy rating data last year, the average new house in Ireland was achieving an A3 building energy rating, with calculated wall, floor and roof U-values between 0.14 and 0.17 — not far off passive. Granted airtightness was averaging 3.8 $m^3/hr/m^2$, but this was a vast improvement on the average figure of worse than 10 $m^3/hr/m^2$ from homes built during Ireland's building boom. The Irish building industry has upped its game — it just needs to keep going.

It's natural, O'Leary says, for developers and contractors who have no experience of passive house to be a bit fearful of of it. "There was a fear or concern, unfounded, that passive house would drive the cost of construction up, and that it would grind everything to a halt. But he points to developer Michael Bennett's passive house scheme in Enniscorthy, Co Wexford as an example of what can be achieved — timber frame, semi-detached passive houses within the Dublin commuter belt that were built in seven weeks, and are now on the market for just €170,000.

"You can't unsee passive house," he says. "Once you've been exposed to the details, the materials, the products…you can never unsee that." He says the Passive House Academy is starting to see an upsurge in people attending courses as designers and tradeseople start to prepare for a new reality.

"In the last six months, we've seen developers sticking their heads above the parapet again," he says. "Whether it's passive house or NZEB, they know that the bad old days are finished."

how to **stimulate** deep retrofit

There was a time when governments thought that simply offering grants for cavity wall insulation and heating system upgrades would be enough to stimulate mass upgrade of our building stock. But 'shallow' measures such as these may not be sufficient to drastically cut carbon emissions and make a real difference to occupant comfort and health, and convincing homeowners to upgrade their homes to a much higher standard will require a clever mix of psychology and smart financing

Words: John Cradden

There's been a fair bit of hand-wringing over post-retrofit inertia over the last few years, with Irish figures showing that the numbers undertaking shallow energy retrofits has fallen off a cliff since 2011. So where does that leave those tasked with persuading sceptical homeowners of the virtues of undertaking deep retrofits, including those to the passive house standard?

Much of the talk appears to have focused on whether or not we should move away from grant-based support programmes like the Better Energy Scheme to more market-based approaches like pay as you save. But at least part of the overall answer may well be found by looking more closely at the psychology of retrofitting, according to Fintan Smyth, building physics manager for Isover Ireland and Gyproc.

A qualified architectural technician, BER assessor and trainer, and passive house designer, Smyth has been living and breathing the issue of how to market deep retrofits in Ireland while also working to promote a sustainability agenda.

Among other things, he was seconded to Ireland's Department of Energy in 2013 to develop viable industry-led proposals for a national residential retrofit strategy as part of the Sustainable Energy Authority of Ireland's (SEAI's) Better Energy Financing project, and earlier this year submitted a dissertation for an MSc in architecture: environment and energy studies (University of East London) entitled: 'New expectations: assessing a marketing proposal for energy efficient retrofit in Ireland".

For Smyth, the issue is less to do with economics as the simple fact that people don't want to buy something they don't really understand. "We've got to find a way to make people want energy efficiency," he said. "At the end of the day, it really isn't about the money because if we, as individuals in a first world country, really wanted this we would find a way to finance it."

Smyth says this point really hit home recently while speaking about financing at an event in University College Dublin. During his presentation, he asked how many of the participants – the very folks who you would expect to 'get it' when it comes to the virtues of deep retrofits – had actually undertaken one on their own home. No-one put up their hand, he said. When he asked why, the only person who responded said simply that he couldn't afford it.

While he accepted that, Smyth also believes it has a lot to do with getting bogged down in the detail and over-thinking the problem, he said. "The more we know, the more we think we need to know and the more expensive it becomes

(clockwise from top) Genuinely deep retrofit measures including external insulation to AECB CEO Andy Simmonds' Grove Cottage; 300mm of platinum EPS floor insulation and attic upgrade at Tina Holt's retrofit in Nottingham; and retrofitting of Munster Joinery passive windows at a Simon McGuinness upgrade in Salthill, Co. Galway

and the further out it goes."

Based on his experience of engaging with the issue of selling deep retrofits, Smyth would class this group as one of four distinct categories of homeowner: architects and other professionals in the field who get entrenched in the complexity and become obsessed with the desire to achieve the most perfect outcome and therefore postpone doing anything significant.

The other categories are: those who have done shallow retrofits or individual measures and believe they don't need to do any more, those who ignore the issue entirely, and finally those — often with an engineering mindset — who just do it.

"You don't see too many of them in my experience, but they are generally engineers, people who say, 'I'm just going to get on with it, I'm going to do something'…For some reason, from a psychological perspective, they just get it and they're also empowered to do it. Whereas the idealists, the architects — myself included for a long time – will talk it to death but maybe will never get there."

Another dimension to the reluctance to retrofit, says Smyth, is the lack of opportunities for most of us to actually experience a properly energy-efficient home, and what that really means in terms of comfort. "You have to experience it in order to understand it or relate to it, for it to be meaningful to you. You'd almost have to live in an energy-efficient home or a passive house for a month to actually say, 'now I get it'."

Indeed, people who retrofit purely for the energy savings are pleasantly surprised at the comfort difference, but would rarely cite that as a motivating factor to begin with, he adds.

Studies by SEAI, however, suggest that comfort gain is a key motivator, with one survey showing that 60pc of households upgraded their homes for comfort reasons, according to Marion Jammet of the Irish Green Building Council, who manages the Irish component of the EU's BuildUpon Project. But she adds that people don't always make totally rational decisions about these things. "Home heating has a strong emotional dimension, and people do not view upgrade options in purely economic terms."

SEAI studies also show that many underestimate the benefits of deep retrofit works, while overestimating the potential time, hassle and cost involved, but speaking to neighbours, family or friends who have gone down the retrofit road is a highly effective mind-changer.

"While people often do not make the connection between energy efficiency upgrades and things that are important to them, such as comfort and the level of their monthly energy bills, hearing the story from somebody they trust is key," says Jammet.

Evidence from our archives to support Fintan Smyth's hypothesis that uptake of deep retrofit among engineer clients includes (clockwise from top left) Norman McMillan's A1 rated upgrade in Carlow; Liam Desmond's near passive upgrade in Mount Merrion, Co. Dublin; an unnamed engineer's Enerphit upgrade in Rathgar, Co Dublin; and married engineers Emma & Rob's deep retrofit in Co Cork, as well as Ian Mawditt's upgrade featured in this issue

She believes focusing on the immediate benefits of comfort and health is the best way to make deep retrofit more appealing, such as highlighting the evidence that cardiovascular and respiratory diseases are worsened by living in cold houses, or that fuel poverty affects mental health.

Fintan Smyth also preaches the gospel of immediacy. He cites behavioural experts like Dr Pete Lunn of the Economic and Social Research Institute (ESRI), who emphasise the importance of talking about the present tense, "to not talk about future deliverables, like long-term energy savings. It needs to be now."
As part of his bid to create a simple, immediate and appealing marketing proposal for deep retrofit, Smyth conducted a small-scale survey for his MSc thesis involving 12 participants who attended a workshop.

To help illustrate his survey questions, he used the example of a deep retrofit he conducted on his own 120 square metre four-bed semi-D home in Dublin that transformed its energy rating from an E to an A at a cost of less than €20,000. This work included external insulation to three of the four walls (the fourth getting a cavity-fill), upgrading the attic insulation, replacing four of the worst windows, upgrading the boiler and heating controls, and a new stove in the sitting room.

He also asked some of the main banks about hypothetically topping up a mortgage by up to €25,000 at a 4-5% interest rate for a retrofit, compared to a standard home improvement

loan — to which they said yes, no problem.

So assuming a retrofit cost of €20,000, Smyth calculated that the mortgage top-up for that amount would be €151 a month over 15 years at current rates.

When he showed his survey participants two identical houses, one with an E energy rating costing €1,250 a month to rent and one with an A rating, he asked them how much more a month they would be prepared to pay to live in the A-rated house. The most common answer was €150 a month. And that was before taking into account conservatively estimated energy savings of around €75 a month for gas and electricity bills — never mind the positive effect on the property's value, or on occupant health and comfort.

A Simon McGuinness-designed retrofit in Salthill, Co. Galway that achieved full passive house certification, working with a local builder with no background in aiming for such high levels of airtightness

"So now I'm living in an A-rated house for an extra €75 a month and when you say that to people… they imagine a different world, their expectations have now been changed; that this is actually possible because they probably spend that much on a mobile phone bill. Now it's a figure they can work with and it gets them over the barrier of affordability."

But another key element of the job of selling energy efficiency should also be actively creating a vision for retrofits and increasing the aspiration factor. Smyth believes deep retrofit needs to be sold as a complete package rather than as a series of individual measures with all their confusing details, which invariably lead to further procrastination.

Indeed, he adds that the existing process for retrofitting tends to be quite a dispiriting one which "just leaves you very lost and alone and in limbo, and you have got no reference or trust or support through the journey, and it's very, very discouraging. We don't bring people on the customer journey very intelligently."

His own method is to contrast what he calls the 'iPhone house' – comfortable, green and attractive — with the 'old house'. The virtues of selling a complete package may well ring true for those who currently market passive house retrofits but, given the undeniably higher capital cost involved, money may inevitably become an issue.

Although Smyth is a certified passive house designer and had set out in 2013 to champion passive house as the retrofit standard as part of the Better Energy Financing project — "because otherwise we were just kicking the can down the road and making problems for the future" — the early feedback he got made him question its economic viability, and prompted him to alter his own psychology in relation to marketing deep retrofits.

The Energiesprong scheme in the Netherlands (profiled in issue 13 of Passive House Plus) has been showing the way forward for cost-effective, cleverly financed deep retrofits. But the lowest cost for any scheme has not fallen much below €70,000 per house for passive-level upgrades, according to Smyth.

The conclusion he came to was that holding out for the 'dream' outcome of a national retrofit scheme based around passive house standards would not be worth it, for what he believes would be minimal energy savings achieved over a retrofit programme driven by Deap, the software used to calculate building energy ratings (Ireland's equivalent to Sap).

"The reason being that, the longer we wait to tackle climate change the bigger the problem is getting in the meantime. Therefore we need to be quite practical about where we say this is good enough." As a keen environmentalist, he is also concerned that a passive house retrofit programme could have a higher carbon footprint.

So even though he knows and acknowledges that passive house works and is better in every way, promoting Deap-driven retrofit is the way to get things moving, he believes.

This of course is exactly what the government's been doing, albeit typically with much shallower measures than proposed by Smyth. At least one critic who begs to differ is passive house architect Simon McGuinness. "They have started on the wrong page, on an incremental path towards retrofit," he says. "The only thing sure about incremental retrofit is that you will lock yourself in financially at some point before achieving your goal. This is because you have not defined your goal at the beginning, you have just defined some of your early steps."

The EU-backed Europhit project, which is coordinated by the Passive House Institute, is using practical examples to demonstrate how to carry out passive retrofits over time. So if you have limited capital now, you might choose to spend it solely on external insulation to passive standard rather than giving your whole building envelope and heating system a shallow upgrade. This means that if you have more funds again in five years' time, you can install another passive element — say triple-glazing — and so forth into the future.

The psychology for success in starting the push for full passive house retrofits, McGuinness says, is to get the right owner at the right time to make the investment required.

This means finding early adaptors, who will tend to be mature clients approaching retirement, perhaps with some history of ill-health within the family. For them, he says, the priority is comfort, convenience, health and security, and the only incentive they would need is a low-interest home loan.

McGuinness talks of a client in Salthill, Co. Galway who has a certified passive house (as featured in issue 11 of Passive House Plus) delivered by retrofit for around €136,000, with the energy saving elements of the upgrade believed to cost around €85,000 – a figure that could be expected to fall in the future as the supply chain increases and economies of scale kick in.

"The very last thing that guy wants is…to set off on a journey without a fixed end point and with an indefinite journey time… He needs to get stuck in, do it once, do it right, and move in and enjoy the comfort. One hit, one standard: passive house certified.

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